

Environmental Stewardship: Reducing Food Waste While Improving Food Security



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UNIVERSITY OF MINNESOTA

Building Community-University Partnerships for Resilience

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Section I: Introduction

Overview

Food, a basic human need, is often taken for granted in a society of relative abundance. Yet in 2015, 12.7% of the population in Ramsey County, Minnesota did not have consistent access to enough food for an active and healthy life or had limited or uncertain availability of nutritionally adequate food. In addition, only one-fifth of Ramsey County 6th, 9th and 12th graders report consuming the recommended five servings of fruits and vegetables per day.

At the same time, food remains the largest source of solid waste by weight in Ramsey County, accounting for 26% of the total trash collected for disposal each year. This represents a loss not only of the nutritional value of edible food that is discarded, but also of the embedded resources it took to produce, manufacture, distribute, and prepare it.

In its 2012 Solid Waste Management Master Plan, Ramsey County adopted the U.S. Environmental Protection Agency's (EPA) Food Recovery Hierarchy as the standard protocol for managing food waste in county planning frameworks. As such, this project will investigate the wealth of information available concerning wasted food, the challenges that exist in diverting edible food to sources where it can be distributed for human consumption, and potential partners who can help address this issue in Ramsey County.

Objectives

1. What percentage of food that is discarded in Ramsey County could be diverted for human consumption?
2. What are the challenges or barriers to diverting edible food from the point of waste to people experiencing food insecurity in Ramsey County? Who are the players that can help to address this issue, and what role can they play?
3. How have other local governments and their partners, either in Minnesota or around the nation, sought to address food waste and ensure that edible food is not discarded? What lessons can Ramsey County learn from these examples?

Main Findings

- By helping facilitate long-term relationships between stakeholders that are built upon food waste diversion/reduction, Ramsey County can maximize sustained impact while minimizing their own effort.
- Drawing from case studies, Ramsey County may find success in:
 - Targeting of lower-power stakeholders (e.g. individuals, small local businesses) in the food waste stream as opposed to higher-power stakeholders (e.g. chain grocery retailers)
 - Redistribution of waste to higher in the food waste hierarchy.
- Based on survey results, a combination of policies centered around the three-tiered approach of “Provide, Educate, and Encourage” may be most effective.
- Open-Source Technology may be used in managing food supply chain operations for businesses and nonprofits
- The Ternary Model of food waste allows organizations to effectively communicate regarding their food waste issues and needs

Section II: Stakeholder Analysis

Introduction and Purpose

In this section, we analyze the stakeholders within Ramsey County and how more effective engagement of these groups or individuals may lead to equitable food justice-based outcomes.

Ramsey County is a large area with many individuals and groupings of individuals, or “stakeholders,” that contribute to and benefit from its infrastructure. As any proposed change to this infrastructure - such as a reduction in food waste - is not made in a silo, its success will in great part be determined by how closely these stakeholders are observed, engaged and monitored in their relation to the change. These dynamics will catalyze problems and barriers through which Ramsey County must reduce resistance but change also allows for great and unique opportunities to bolster adoption. In other words, stakeholders have the power to make or break any initiative, and their successful engagement is key. Due to limited resources, Ramsey County must also be thoughtful and strategic in their stakeholder efforts to create the largest and self- sustaining result possible. This section seeks to provide a foundation, framework and several live resources for that effort, and it also contributes groundwork for subsequent sections below.

Definitions, Scope and Framework

A working definition and scope of “stakeholder” was first developed to help frame this analysis. We found a stakeholder to be any living entity or grouping of living entities that can directly or indirectly influence or be influenced by Ramsey County’s effort to reduce and divert food waste and are interested in the effort’s success or failure. Though heavily focused on people, nature and animals were not fully excluded from the analysis given the apt “nature” of the topic. Some included stakeholders, such as visitors and neighboring counties, were peripheral and inherently lower priority yet were still included because they offer an interesting perspective to reach a more comprehensive analysis. For entities that are national and/or hold some presence in both Ramsey County and various other locations as well, the analysis typically focuses on only those branches that reside within Ramsey County.

This definition and scope were then used to brainstorm and wrap our arms around as many relevant stakeholder categories as possible. The initial goal was to cast a wide net to err on the side of excess

inclusion - it was seen as more harmful to leave out a key stakeholder than include a lower priority one. Yet after recording over 40 such stakeholder entities, we decided that although the list was not exhaustive, any larger may prove unhelpful and overwhelming from an analysis standpoint. In fact, our next step was to group these 40 stakeholders into five categories that share similar functions and characteristics: for-profit companies, nonprofit and public organizations, large spaces, individuals/households, and nature/environment. Stakeholders were analyzed both individually and as a part of these larger categories. It is also worth noting that not all stakeholders are equal in value to this analysis and potential impact to Ramsey County's food waste initiative.

So although we initially strove purely for breadth to provide Ramsey County with context and framing - with the core conclusion at this stage being that this project can be as big and complex as they want it to be - the true value with limited resources comes from a combined rifle-like depth on the stakeholders of highest value and adding shotgun-like engagement strategies that reach multiple stakeholders at once. The importance of retaining breadth in engagement strategies is to ensure that Ramsey County has sufficient adoption of food waste reduction/diversion to encourage a tipping point across stakeholders and to alter what these groups view as the "norm." Conversely, depth can instill commitment and empowerment of specific high-impact stakeholders who will then become self-sustained and even take charge of the efforts rather than continuously lean on Ramsey County's limited resources.

Tools and Resources from Analysis

With definitions and groupings of stakeholders determined and a recommended approach of breadth and depth settled, the next major step of the analysis could begin: providing prioritization and sharing specific opportunities, costs and concerns for each stakeholder, from which key engagement recommendations could be derived. In this step, a series of living documents were created to serve as initial resources for Ramsey County to not only help shape their (and our) directions for research, engagement and further information gathering, but also as ongoing tools that they can edit, build upon and share as their needs grow and as they deepen their work with each individual stakeholder group. These documents are shared below in the appendix, and editable versions can be found on the shared Google Drive folder (links in the appendix as well).

Stakeholder Analysis – Detail

The first and primary document is a detailed breakdown of each stakeholder. A spreadsheet table format was selected so that similar criteria could be observed across each stakeholder in a single concise and digestible page (albeit a lot of information). Each category mentioned above is split into its own sheet.

After providing the stakeholder name and some examples (when applicable), the next four columns seek to help Ramsey County with prioritization for which stakeholders will add the most value to the initiative through proper engagement. The “power” score demonstrates the extent to which the stakeholder has the ability to positively and/or negatively influence the overall success of the initiative (i.e. how much weight they have to throw around). The “interest” score demonstrates the extent to which the stakeholder would actively care about the initiative if they were engaged (i.e. their likelihood of adoption). The “current engagement” score shows the extent to which the stakeholder is already being engaged in the initiative - either by Ramsey County, other entities or inherently in their line of work. These factors - along with more subjective judgements - play into the overall priority score, which is the assumed overall benefit the initiative will have if they were strategically engaged. Ones with a higher priority score should receive more of Ramsey County’s focus until their engagement is increased and self- sustaining.

The next two columns observe unique benefits and costs from the stakeholder’s point of view if they were to more fully engage in reducing and diverting food waste. Some examples of common benefits are reduced costs, increased efficiency, greater community interaction, and better reputation and publicity, while some examples of common costs were expenses from new vendor relationships/contracts, effort/time commitment, and risk. In all cases, we found the benefits to outweigh the costs, and these should be fully presented to stakeholders during engagement - and their feedback should be requested to continue expanding on both columns and increase understanding of their perspectives.

The final two columns (sans “other comments”) list specific ways in which the stakeholder can be effectively engaged, and the general individuals within the stakeholder entity whom may be most impactful to engage through. Many ideas - especially within each category - could be applied to many stakeholder groups (e.g. survey, group dialogue, policy changes). And again, these were a

start to the brainstorming process and should be expanded upon and refined by Ramsey County as stakeholders provide feedback.

Stakeholder Cross Engagement Matrix

Though this table format was helpful for organizing individual stakeholders, it was difficult to comment on how each of the greater categories also offer opportunities for direct cross engagement between one another. A second spreadsheet was developed for this purpose, and a matrix was formed to show how the stakeholders could best engage. By helping facilitate long-term relationships between stakeholders that are built upon food waste diversion/reduction, Ramsey County can maximize sustained impact while minimizing their own effort. This tool also includes a section at the top covering “all,” which are engagement methods that can be used interchangeably between any categories or - perhaps most impactful and highly recommended - used with all categories at once. This is a tool where Ramsey County can not only list such engagements as they test and observe them between stakeholders, but they can also expand these notes to address what has worked well and what has not (and perhaps even ranking them) to avoid repeating ineffective strategies.

Supplemental Document to Detailed Spreadsheet

The aforementioned two tools are helpful for organizing and prioritizing information, but spreadsheets have limitations on formatting and functionality. It was discovered quickly that they are not conducive for including sub-comments or links to real examples or other sources of information. A supplementary document was thus formed and added to the Google Drive to allow for expanding this content as needed. It is organized into pages: the first shares the key question and primary objective of the analysis, followed by a short summary of the top few recommendations from the analysis in order to have the highest impact of engagement (discussed below). The pages that follow dive deeper into each category, starting with links to specific examples of each stakeholder group and followed by links and expanded ideas of engagement ideas. When found, links for stakeholder group examples were provided directly to the articles or sites related to the topic, not just a company itself (e.g. a video from Cub Foods’ Zero Waste campaign).

Limitations and Next Steps

There are several noteworthy limitations to this section and recommended next steps. First, opportunities were not tested as a part of this analysis. Some of the suggestions may be found ineffective or better applied to different stakeholders, and others that are not currently on the list may have the greatest impact. Similarly, the scores for each stakeholder's power, interest, current engagement and priority level may need to be refined through Ramsey County's actual experience, and they may discover different benefits and costs as well. It is recommended that these tools to be used as a starting point and perpetually refined through further research and trial and error, and the sections below start this process.

The second major limitation was time. There are surely countless examples, studies, and resources available to help develop strategies to engage stakeholders in reducing/diverting food waste in Ramsey County, and this information could be organized in countless ways as well. A semester project only scratches the surface of this initiative that is best viewed as a massive continuous improvement effort - accumulating and snowballing information, resources and stakeholder support along the way.

Section III: Gaps Analysis & Case Studies

Introduction

Municipal solid waste (MSW) is comprised of many different materials. According to a 2015 report compiled by the United States Environmental Protection Agency (EPA), approximately 15% of MSW can be categorized as food waste (2015 EPA Report). Once it enters the waste stream, food waste can be composted, combusted for energy, or sent to a landfill. A total of approximately 39.73 million tons of food waste were generated in 2015, of this waste 2.10 million tons were composted (representing 5% of the total food waste), 7.38 million tons were combusted for energy (representing 19% of the total food waste), and 30.25 million tons of food waste were sent to a landfill (representing 76% of the total food waste).

There have been increasing efforts to reduce the amount of food waste that is sent to landfill annually.

There are challenges that arise with analyzing the changing trends in food waste over time. For instance, many analyses of evolving trends place food waste in the category of “organics.” In 2015, 9% of the materials composted were food waste, compared to 90%-yard waste. Additionally, 22% of the materials combusted for energy were food waste, while the other 78% were comprised of a variety of other materials. Therefore, trends that describe changes in organic waste over time may not be robust measurements to accurately quantify the changes in food waste, as these data suggest that food waste makes up a small component of organic waste. The frequent grouping of food waste with other organic components makes measuring the impact of policy or strategy changes on food waste non-trivial, and in some instances, precludes it entirely. For these reasons, gaps and strategies are addressed below, but there is no discussion of the impact of these strategies on the waste stream.

In Minnesota, the Select Committee on Recycling and Environment (SCORE) generates a SCORE Report. This report collects information on waste from counties (2016 SCORE Report). Much of the food waste in this report has been compiled into a category labeled “organics”. In Minnesota, 10% of MSW is comprised of organics. In the greater Minnesota area, food comprises 5.5% of organic waste-- amounting to 0.057 lbs./person/day). This number is increased over two-fold in metropolitan areas, where food comprises 14.8% of food waste-- amounting to 0.149

lbs./person/day. This indicates that cities and metropolitan areas may possess increased challenges when combating food waste compared to more rural areas. Focusing on strategies or policies implemented in areas that possess similar demographics, as opposed to not addressing demographic discrepancies when identifying potential waste reduction strategies, may be more favorable in the identification of policies and procedures that can be used to decrease food waste in Ramsey County (RC).

Gaps Analysis: SCORE Report Analysis

The 2016 SCORE Report details resource allocation of different counties. Ramsey County possesses some differences in these values when compared to nearby counties Hennepin County and Washington County. These differences are detailed in Table B-1, with notable differences bolded for emphasis. Ramsey County reports nearly 3-fold greater revenues based on combined service fees and process facility tip fees compared to Hennepin County and Washington County. For expenditures, Ramsey County spent approximately \$1 million more on both planning and administration and recycling than Hennepin County. Notably, Ramsey County did not report expenditures for source reduction (compared to \$33,500 in Hennepin County) and reported \$3,021,470 in expenditures for waste-to-energy processing (compared to \$0 in Hennepin County). Finally, Ramsey County diverted nearly two-fold more tons of organics for food-to-livestock programs than Hennepin County, and diverted 2,663 tons of food to people (compared to 0 tons for Hennepin County).

The data summarized in this report may indicate that Ramsey County likely possesses a robust food redistribution and rescue infrastructure to divert food waste. These data may also indicate areas where Ramsey County can invest to reduce food waste, primarily in source reduction. In 2015 the Office of the Legislative Auditor recommended that Minnesota place a greater focus on source reduction and reuse of waste, rather than focusing on recycling efforts. Greater investment into source reduction efforts may be one strategy to decrease food waste in Ramsey County, as opportunities in recycling may already be saturated.

Food Waste Reduction and Rescue.

Households contribute the greatest amount of food waste (43%, per NRDC reports) compared to other sources like grocery retailers and the hospitality industry. There are challenges that exist when

targeting consumers for waste reduction, among them being a lack of motivating factors compared to retailers. Retailers handle large amounts of food, receive tax benefits for donation, and the removal of excess product from stores reduces waste fees. Nationally, there has been a push to increase the redirection of food that would otherwise be wasted to feed people (see food-to-people in Table B-1 in Appendix B). For the reasons described above, large grocery retailers are among those most heavily targeted for food rescue. Much of the food rescue effort has been headed by the National Resource Defense Council (NRDC), which has piloted studies in different cities to assess the status of food waste, determine the amount of food waste that is suitable for human consumption, and identify sources of food for food rescue. To reduce food waste, the NRDC has made a number of recommendations for reducing food waste, including (but not limited to):

- Establish baseline levels of food waste.
- Engaging local businesses and communities.
 - Communities: education, public service campaigns
 - Businesses: recognition programs, technical assistance, grant programs
- Incentivize produce donations from farms.
- Expand food donation infrastructure.

Additionally, the NRDC has made strategy recommendations to reduce food waste, not necessarily for state or local governments. Many, but not all, of these recommendations are provided below. Many of these strategies employ the use of new technology. Technology has made a demonstrated difference in the reduction of waste. For instance, when Craigslist entered the market in the early 2000's, an estimated 2-6% reduction MSW was reported per capita (2016 SCORE Report). Because of the demonstrated power of technology on influencing the waste stream, many of the strategies discussed below employ uses of technology.

- Reducing food waste:
 - consumer education campaigns
 - waste tracking and analytics
 - standardized data labeling
- Encouraging food donation:
 - donation tax incentives
 - standardized donation regulations
 - donation matching software
 - donation transportation/storage/handling

Twin Cities Food Rescue Ecosystem

Many of the recommendations made to local governments toward the goal of reducing food waste and encouraging food rescue are already addressed by key stakeholders in the food rescue community. One key stakeholder in RC food rescue is Second Harvest Heartland (SHH). The areas addressed by SHH in within the recommendations made by the NRDC include: expansion of the food donation infrastructure, incentivization of produce donations from farms, and engaging large grocery retailers and caterers located in the Twin Cities. SHH provides technical support for partners by tracking waste data for tax donations, stores/transport/distributes food donations, and collects produce donations from farms.

SHH plays a central role in the food rescue infrastructure. SHH mentors growing food shelves and assists them in finding grant funding when necessary. They report that, per their size and output, they are the second most efficient food rescue organization nationally. SHH is a distributor for rescued food products from various sources: large grocery retailers, farms (via the Agricultural Surplus Program), and hospitality (via the app Meal Connect, developed in collaboration with Feeding America). SHH works with grocery retailers by assisting them in collecting enhanced tax credits, which require weight measurements of produce donated.

Opportunities for Ramsey County

It ought to be emphasized that SHH is a food diversion and not a waste reduction program. Opportunities may exist in partnering with SHH to encourage waste distribution to higher in the food waste hierarchy, as much of their waste is currently being sent to compost. Additionally, it has been noted by senior staff at SHH that there have been difficulties with partner organizations refusing blemished produce due to a lack of knowledge about cosmetically imperfect produce. Therefore, opportunities may exist in partnering with SHH in campaigns that educate consumers with regard to produce imperfections (e.g. blight) that are harmless and frequently occur in locally grown Minnesota produce.

Individuals at SHH have stated that the renegotiation of waste fees for non-profit organizations within the county may be favorable for their food distribution efforts. It is unknown what impact, if any, renegotiation of these fees would have on waste. Renegotiation of waste fees can be postulated

to increase the product flow through the organization. Due to the status of the organization as a food rescue program and not a food waste reduction program, it is possible that a renegotiation of these fees that does not address the food waste issue at hand may result in an increase in food waste in RC. It is therefore suggested that, if this strategy were implemented, it may be advantageous to require food waste reduction as a part of the negotiation process. This would theoretically assist RC in achieving its goal of increasing food rescue as well as decreasing food waste.

In addition to SHH, many other food rescue organizations exist in Twin Cities (see Table B-2 in Appendix B). While the NRDC recommends the expansion of food rescue infrastructure as a method to combat food waste, evidence suggests that this may not be necessary for RC specifically. As discussed above in the SCORE report analysis and reiterated in the discussion of the Twin Cities Food Rescue Ecosystem, food rescue is a well-addressed gap in the waste stream. Instead, efforts to reduce food waste may be more strategic opportunities for RC, particularly in the areas of source reduction and consumer education. It is encouraged that RC establish county-specific baseline levels of food waste as recommended by the NRDC, as it is postulated that this data should identify additional opportunities for RC. Summarized in Table B-3 are gaps in the food waste pipeline that are hypothesized to be present in RC (but cannot be confirmed due to lack of data), general strategies that have been used to fill these gaps, different examples of how these strategies have been implemented, and potential local partnership opportunities for RC.

Case Study Analysis

A diverse range of strategies can be used to address each of the current gaps in the food waste reduction and recovery pipeline. Here the types of programs that may be low-hanging fruit for Ramsey County to reduce food waste are identified, as outlined in Table B-3 in Appendix B. Examples are provided of how these types of approaches have already been implemented to reduce food waste in other locations.

Strategy 1: Consumer Education Campaigns

Campaigns to inform consumers about the food waste problem can use many different ways to distribute information such as social media, TV or radio ads, billboard or print ads, mail flyers, or in-person training sessions. Thyberg and Tonjes (2016) describe the aims of such campaigns as

“values”-centered, being focused on the moral obligation to reduce the amount of resources lost to the problem and promoting the value of money saved from less wasteful spending on food, or “skills”-centered, focused on teaching consumers skills they can use to reduce food waste like smarter shopping habits, improved food storage, meal planning and meal prep, and tips for how to use leftovers.

Boulder/Broomfield County School Recycling and Environmental Education Program. Local non-profit Eco-Cycle provides training to cafeteria staff and students on food waste reduction and food scrap composting. Upon completing the program, schools become certified "Green Star Schools." Participating schools have been able to reduce landfill waste by one third due to diversion of food scraps, nonrecyclable paper, and paper towels to newly set up composting systems.

(<http://www.ecocycle.org/schools/overview>)

Oakland Unified School District Green Gloves Program. School district provides educational program for students to learn about and reduce their environmental footprint. Students learn to reduce cafeteria waste by sorting into compost, recycling, and landfill categories. (<https://www.ousd.org/Page/944>)

FeedBack. FeedBack is an international organization that designs campaigns to reduce food waste and improve sustainability of the food system. For example, their “Feeding the 5000” campaign has raised awareness of the food waste problem by hosting large community feasts with rescued food that would have otherwise been wasted. (<https://feedbackglobal.org/campaigns/feeding-the-5000/>)

Strategy 2: Gardener Engagement

Gleaning is the practice of collecting food from gardens, orchards, or other agricultural lands that would otherwise not be harvested and eaten. It is seen as an effective way to improve food security, especially availability of high-quality fresh fruits and vegetables, while reducing the proportion of food going to waste in the field. Transporting gleaned produce directly to food shelves or meal programs is an effective way to use produce that may be approaching its expiration date (making it unmarketable) but is still safe for immediate consumption, and also provides high-quality fresh produce to food shelves that may otherwise not be able to afford it.

(<https://thefoodgroupmn.org/gleaning-to-fight-hunger/>)

Urban Harvesting Program. San Francisco Public Works initiated a program to help collect and distribute fresh fruit from urban trees to food shelves and meal programs. Residents can contribute to the program by registering their fruit tree for harvest by volunteers.

<https://www.sfpublicworks.org/urbanharvesting>)

Garden Lease Program/Homegrown Minneapolis. Minneapolis created a program allowing garden groups to lease city-owned plots for community gardens

<http://www.ci.minneapolis.mn.us/sustainability/homegrown/WCMSP-170166>). This program connects with the citywide Homegrown Minneapolis initiative, which provides resources and connections for growers, nonprofits, local businesses, and community groups to improve distribution and access to healthy local foods.

<http://www.ci.minneapolis.mn.us/sustainability/homegrown/index.htm>)

Strategy 3: Food to Livestock

In the food waste hierarchy (Papargyropoulou 2014), diverting food waste to livestock lies below the priorities of reducing wasted food and donating food to hungry people, but above the less desirable options of composting and sending food waste to a landfill which contribute to greenhouse gas emissions. The primary environmental benefits of directing food waste to animal feed come from being able to replace other sources of animal feed and thus the resources that typically go into creating those products (Salemdeeb 2017). A recent study from the University of Minnesota showed that supermarket food waste is likely to contain relatively high levels of nutrients that are often growth-limiting in corn-and soy-based meal diets in pigs, making it an ideal addition source of food for these animals.

KDC Agribusiness. A New Jersey-based private company developed methods to convert commercial food leftovers into high quality animal feed and organic fertilizer (<http://kdcag.com/>)

Strategy 4: Expanded Organics Recycling Services

Organics recycling services are becoming increasingly common across the country in recent years. The number of residential food waste collection programs in the US increased 87 percent from 2014 to 2017, according to a 2017 report from BioCycle. In the same study, the majority of survey respondents reported that they considered their recycling program successful due to their effectiveness in helping to meet waste diversion goals.

Portland, OR. Yard waste organics collection was expanded to include food waste.

Curbside pickup services are offered weekly, and online resources are provided with collection guidelines and tips for food waste composting.

(<https://www.portlandoregon.gov/bps/article/402972>)

Austin, TX. All properties must provide recycling for tenants and employees as of October 2017. This expanded recycling is part of the city's plan to have "zero waste" by 2040. Austin has set waste diversion goals for every five years and will begin implementing an organic waste diversion requirement for all businesses with a food permit. (<https://austintexas.gov/zerowaste>)

San Francisco, CA. Composting and recycling are mandatory for all San Francisco residents and businesses. (<https://sfenvironment.org/recycling-composting-faqs>)

Strategy 5: Food Waste Drop-Off Sites

Local food waste drop-off sites for residents to recycle food scraps are a relatively new trend with over half of the current programs in the US reportedly being established within the last three years. Services can vary from location to location: some sites are open a few designated hours per week while others have 24-hour access; some provide resources like compostable bags while others do not. In Minnesota, Anoka County now provides bins for food waste at the county's two-yard trimmings drop-off sites. Organic waste drop-off programs may offer an advantage over curbside pickup in terms of ease of implementation and low cost but may also have the drawback of being difficult to gain large-scale participation from residents. Of 30 food waste drop-off programs nationwide that responded to the 2017 BioCycle survey, 25 reported that their program was successful, and none considered their program unsuccessful.

Western Lake Superior Sanitary District (Duluth, MN). Seven food waste drop-off sites are available throughout the Duluth area. Compostable bags in two different sizes are provided free of charge at the sites (<https://wlssd.com/services/food-waste/drop-off-instructions/>)

Tompkins County, NY. Food waste drop-off program was started with eight drop-off locations and has since increased to fourteen, and scraps are sent to a local composting company. There is no charge for the service for residents, and the county provides free compost caddies, liners, and transport containers. In 2015, approximately 200 tons of kitchen scraps were diverted from landfills through the drop-off program. The county also operates a separate program called ReBusiness for businesses. (<https://recycletompkins.org/recycling-and-composting/food-scraps-recycling/>)

Love Food Not Waste (Eugene, OR). A citywide effort started in 2011 to collect food waste from businesses to divert to a local composting company, Rexius. Over 200 local businesses participate, and the program recently expanded to begin curbside organics collection from households.

(<https://www.eugene-or.gov/759/Commercial-Food-Waste-Collection>)

Strategy 6: Recycling Contract Negotiation for Businesses

Offering discounted recycling services to businesses provides incentive for recycling and has high potential for diverting waste since it targets large producers of waste rather than individual households.

Love Food Not Waste (Eugene, OR). As part of the Love Food Not Waste initiative, businesses are entitled to sign up for food waste recycling services at 20% below garbage hauling rates and can receive free training from the city.

Cupertino, CA. A waste reduction initiative was started in 2010 by the City of Cupertino and local waste management company Recology in partnership with the EPA's Food Recovery Challenge program with the aim of helping to meet the city's goal of diverting 75% of Cupertino's waste from landfills. The city required that the goals must be met in order for Recology to be eligible for a five-year contract extension. This negotiation encouraged Recology to work closely with local food vendors and train them to optimize organics recycling. (<https://archive.epa.gov/region9/mediacenter/web/html/index-9.html>)

Strategy 7: Anaerobic Digestion

In the anaerobic digestion process, organic material is broken down by microorganisms in absence of oxygen to produce methane and carbon dioxide. Anaerobic digestion of organic waste is preferred to sending waste to a landfill because the methane gas produced can be captured and used as an energy source. Many anaerobic digesters are already in place for use in wastewater treatment facilities, and there is a movement toward processing food waste in these same facilities, providing an opportunity to capture energy from foods that have not been eaten by humans.

(<https://www.epa.gov/sites/production/files/documents/Why-Anaerobic-Digestion.pdf>)

Digester Renovation with Alternate Power Sources (West Lafayette, IN). The City of West Lafayette repurposed an existing anaerobic digester at a wastewater treatment plant to process food waste from Purdue University. (<https://www.purdue.edu/discoverypark/energy/assets/pdfs/energy-camp-presentations/West%20Lafayette%20Waste%20Water%20Treatment%20Plant.pdf>)

Hennepin County, MN. The county has begun looking into anaerobic digestion as a strategy to reduce the proportion of its waste going to landfills. A request for qualifications was recently published (due date was October 2018) in search of potential partner companies that can run a digester facility at the capacity needed.

Strategy 8: Donation Matching Software

Appropriate technology can greatly improve the efficiency and scale of food rescue by connecting food donors with the right recipients based on what types of food are needed, what kinds of storage are available, and timing of transport and delivery. With the right technology and connections in place, food shelves can better control their supply and receive advanced notice of donations to be prepared to receive. (Frasz et al 2015)

Food Rescue US (formerly Community Plates). This app connects food retailers, volunteer food transporters, and food pantries or meal programs.

Strategy 9: Consulting services and software to help small businesses analyze, reduce, and manage waste

Understanding the problem of food waste, potential for saving money, and solutions to reduce waste are essential first steps before a business can take action to address the problem. Food waste tracking software or in-person waste sorts are common methods for gaining insight into the type and amount of food wasted as well as potential for savings by switching to less wasteful practices. In-person or online consulting sessions with professionals who have a deep understanding of available services and funding opportunities can allow businesses to make informed decisions about setting up new recycling programs.

Food Waste Experts. Consultants provide information and solutions to reduce food waste for restaurants, schools, hospitals, hotels, and other organizations that prepare and serve food.

Conclusions

A Ramsey County specific description of food waste can be observed in Figure C-1.

There are 2 major categories that strategies to address these gaps fall into: 1) Targeting of lower-power stakeholders (e.g. individuals, small local businesses) in the food waste stream as opposed to higher-power stakeholders (e.g. chain grocery retailers), and 2) Redistribution of waste to higher in the food waste hierarchy. The online EPA Managing and Transforming Waste Streams tool was identified as a useful resource for finding many examples of recycling/waste policies implemented by municipalities around the country to more effectively manage organics waste.

This tool was used to find case studies that may be implemented to address the aforementioned RC-specific gaps in food waste reduction and redistribution. A number of organizations operate in Ramsey County that are identified as potential partners in these strategies, should they be modified and implemented in Ramsey County. These organizations are outlined in Table B-2 and Table B-3. Overall descriptions of these strategies and how these individual partners may be engaged are also provided in Table B-3. Many of these strategies contain broad descriptions of entities such as “small businesses” and “local grocery stores”. Descriptors of such entities can be found in the Stakeholder Analysis section of this report, and these two tables may be used in tandem to generate an overall waste reduction and redistribution strategic engagement plan.

Many of the case studies selected in this report focus on the engagement of these low-powered entities, addressing the first major gap hypothesized to be present in RC’s food waste stream. These strategies include: consumer education campaigns, gardener engagement programs, donation matching software, and consulting services. Consumer education and gardener engagement focus on the engagement of individuals within the community, while donation matching software and consulting services have the capability of engaging small local businesses. Suggested programs for consumer education incorporate environmental stewardship programs targeted to individuals of many age ranges and diverse backgrounds, with the goal of food waste reduction. Gardener engagement strategies aim to mobilize motivated members of the community with the goal of excess food redistribution. Donation matching software engages local businesses toward the aim of food rescue, while the availability of consulting services engages local businesses toward the aim of waste reduction. In summary, these strategies and their accompanying case studies represent the engagement and mobilization of individuals and small businesses in the community toward RC’s

goals of both waste reduction and waste redistribution.

Many of the other strategies outlined in this report address the redistribution of waste to higher in the food waste hierarchy, addressing the second major gap hypothesized to be present in RC's food waste stream. These strategies include the expansion of food-to-livestock programs, the implementation of food waste drop-off sites, recycling contract renegotiation, and anaerobic digestion. Some of these strategies are targeted at smaller local businesses and non-profit organizations, such as expansion of the food-to-livestock programs. Others involve waste management strategies such as the formation of an anaerobic digestion facility and recycling contract negotiations. Finally, others target individuals through the formation of food waste drop-off sites to create fertilizers and enhance soil quality. Overall, these strategies involve a variety of stakeholders toward the RC's goal of reducing the amount of food waste sent to landfill, and instead promotes redistribution of food waste across the food waste hierarchy.

Section IV: Survey of Food Waste & Donation in Ramsey County Survey Objectives

As part of the objectives laid out in the scope of work of this project, a survey of the issue stakeholders was designed. Several of the key questions in the present project's scope of work guided the survey objectives, which were:

1. What are the barriers to diverting edible food from the point of waste to people experiencing food insecurity in Ramsey County?
2. Who are the players that can help to address this issue (e.g., businesses, schools and other institutions, government, community garden organizations, consumers, etc.), and what role can they play?
3. What percentage of food that is discarded in Ramsey County could be diverted for human consumption?

The survey was designed primarily to try to answer the first question, which was thought to be a foundational question. Understanding the barriers to diverting edible food is crucial for Ramsey County and other stakeholders in order to answer the second question- which actors can help address this issue and how? To understand how to reduce food waste and divert edible food to the people in need, knowledge is needed about which barriers in the system exist that prevent more edible food from being diverted.

The third key survey question about quantifying the percentage of food discarded that could be diverted is difficult to answer. Answering this question requires precise data across many sectors, strong assumptions, and high survey participation. Where it was possible to ask questions about quantifying the amount of discarded food amongst stakeholder groups in the survey it was done in an effort to try to get some estimate for Ramsey County. Due to the limited timeframe of the project, however, it should be understood that estimates vary greatly in accuracy and would not completely answer this third question.

Final Survey Objectives:

1. To assess stakeholder* food waste, donation, and composting, by stakeholder type.
2. To assess stakeholder* barriers to food donation, composting, and food diversion to animal feed, by stakeholder type.
3. To assess stakeholder* attitudes towards food waste reduction efforts, by stakeholder type.

* Stakeholders in the case of the survey are defined as K-12 school districts, local grocery stores, and hospitals.

Selection of the Stakeholders

For the issues of both food waste and food insecurity, there are many stakeholders involved (see Section III on stakeholder analysis). Team discussions concurred that a narrowing of the stakeholders surveyed was needed in order for the survey design to be completed within the project timeframe, to ensure stronger survey participation, and to focus team efforts on eliciting more precise, rather than broad, data responses. Selection of the stakeholders to be surveyed was the result of team discussions and consultation of the literature.

In the Natural Resource Defense Council (NRDC; 2017a) report, *Modeling the Potential to Increase Food Rescue: Denver, New York City and Nashville*, estimates of food waste generated by different sectors is presented for three cities. Far and away, the residential, restaurant, and catering sectors represented the largest contributors to food waste (see Figure 1); together, they contribute roughly $\frac{2}{3}$ of the total food waste in each city. While representing the largest contributors to food waste, residents and restaurants were not chosen to be stakeholders surveyed. This is for several reasons.

Firstly, these specific stakeholder groups are composed of numerous, disparate, and heterogenous categories or individuals, and obtaining contact information would be difficult. Thus, there were worries about high enough survey participation rates. Secondly, in the same NRDC (2017a) report, the restaurant sector was estimated to have relatively small volumes of rescuable food per location. Likewise, the residential sector likely has small volumes of rescuable food to divert per household. With small potential for rescuing food (i.e., diverting edible food to those in need), these stakeholders were not a priority to survey.

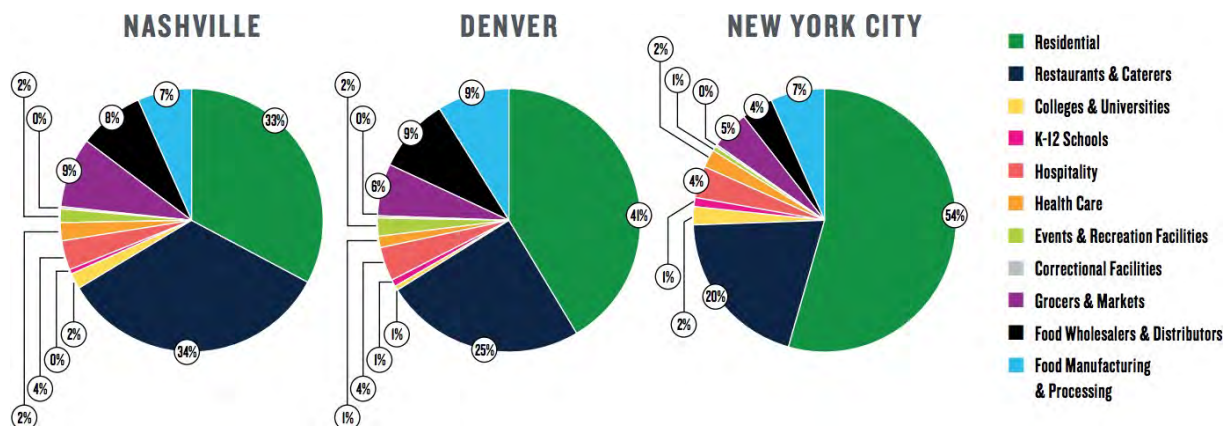


Figure 1. Estimated Food Waste Generated by Sector in Nashville, Denver, and New York City

When breaking down the food waste generation by supply chain stage, farms represent the third largest source of food waste (NRDC, 2017b; see Figure 2). And while the EPA Food Recovery Pyramid emphasizes the importance of source reduction, the survey team decided that any attempts to survey food waste at the farm level were out of scope for this project. Farms outside of Ramsey County distribute food to many locations both in Minnesota and across state lines. While some of that food ends up in Ramsey County, it would be difficult to tease out exactly how source reduction on MN farms could impact food security in Ramsey County.

Additionally, while there are farms in Ramsey County, they are few in number. For the scope of this project, farms were not considered a priority group to survey and not selected to be part of the survey. Instead, the stakeholder groups chosen to participate in the survey were local grocery stores (includes convenience stores), hospitals, and K-12 school districts in Ramsey County. Grocery stores have both large food losses and large rescuable food potential. Estimates of total in-

store food losses in 2010 were 43 billion pounds (Buzby et al., 2014). According to the NRDC (2017a), across Denver, Nashville, and New York City, grocery retail showed the largest untapped potential for food recovery (see Figure 3).

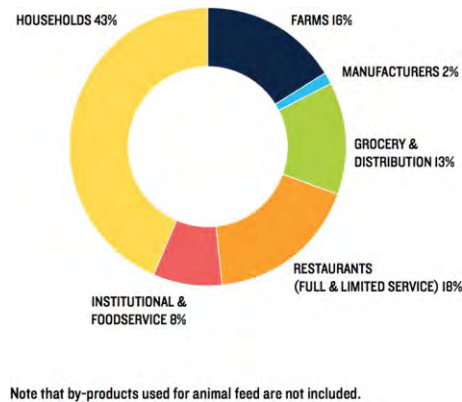


Figure 2. Breakdown of Food Waste Generation by Supply Chain (2015 Estimate)

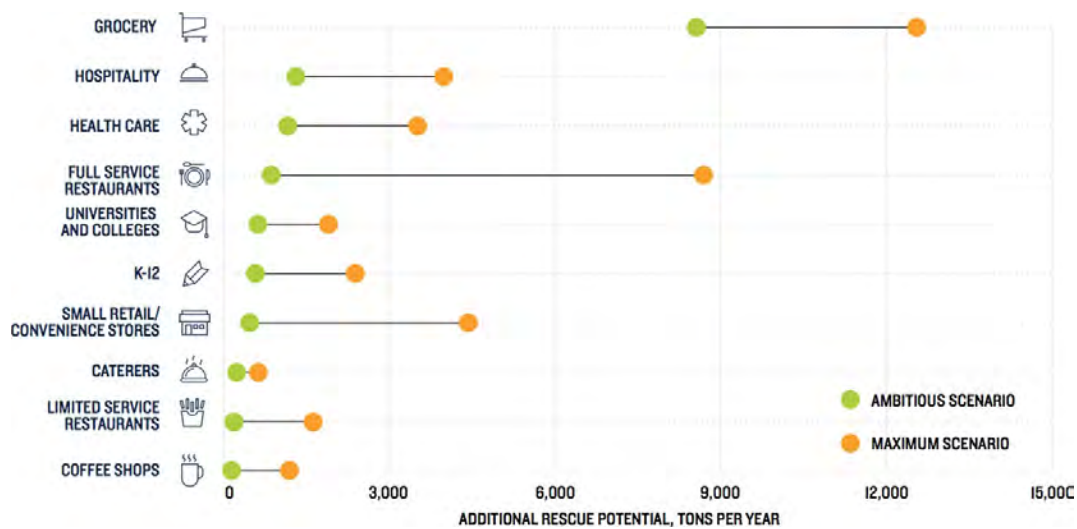


Figure 3. Breakdown of Food Waste Generation by Supply Chain (2015 Estimate)

Note. The ambitious scenario describes the amount of rescuable food that could be available using more realistic assumptions. The maximum scenario estimates of rescuable food are the most optimistic assumptions made by the researchers under optimal conditions. See report for more detailed definitions.

Under the NRDC's ambitious food recovery scenario the grocery sector represented 60% of the untapped potential. The potential for donation was greatest for perishable foods such as fruits, vegetables, meat, dairy, and deli items. For this reason and because the team believed finding contact information would be easier, local grocery stores were chosen as one stakeholder group to survey.

Additionally, K-12 schools and hospitals in Ramsey County were chosen to survey.

These sectors were also reported by the NRDC to have great potential to donate large volumes of food. The NRDC report recognizes that the institutional food service sectors have about 26 percent of the untapped potential for food rescue under the ambitious scenario. This includes prepared food donation potential. While our survey didn't focus on several of the important institutional food service sectors (e.g. hospitality, universities) due to time frame and a desire to survey the stakeholders that were easiest to contact, we did focus on two of the other institutional food service providers. For the above-mentioned reasons and Ramsey County's closer contacts with these institutions, hospitals and K-12 schools were also selected to survey.

Selecting the stakeholder groups that are reported to have the greatest potential to donate food and that were the most feasible to survey, allowed the survey design to try to meet the defined survey objectives within these groups in Ramsey County.

Survey Methods

Participants

Sampling Method. All institutions that were contacted to participate are located within Ramsey County. We contacted all hospitals, school districts, and local grocery stores for which we had obtained contacts to participate in our survey. Email contacts for hospitals and schools' districts were obtained through Ramsey County Statewide Health Improvement Partnership (SHIP) Coordinator, Carissa Glatt. Hospitals were contacted primarily by email if no response was received; follow ups were provided by email or, if necessary, by phone. Phone numbers for local grocery stores were obtained through a Geographic Information Systems (GIS) file, procured by Carissa Glatt, to obtain email contacts for local grocery stores. The researchers called the phone number for each grocery store provided by the GIS file to obtain the email of the manager, store

owner, or another appropriate representative of the store to fill out the survey. During the call, the researchers gave a brief description of the study. Results of the phone calls, including numbers not in service, those that declined to participate, those that gave information to participate, etc. can be found below in Table 1. Contacts for chain grocery stores were not obtained because no list of corporate contacts was readily available, and the researchers had insufficient time to locate the appropriate contact at the corporate headquarters.

Table 1: Sampling information for Ramsey County Food Waste & Recovery survey.					
	Contacted	Declined	No Answer	Given Survey	Completed Survey
Hospitals	3	0	1	2	1
School Districts	6	0	0	6	6
Local Grocery Stores	92	18 (19.6%)	48 (52.2%)	26 (28.2%)	12 (13.0%)
<i>Note.</i> Called or contacted = Number of institutions the researcher attempted to call or contact; Declined = Number of institutions that declined to participate or hung up multiple times when told what we were calling for; No Answer = Number of institutions that did not respond after multiple attempts at contact; Given Survey = Number of institutions surveys were emailed to; Completed Survey = Number of institutions that completed the survey.					

Final Participant Makeup. A total of 1 hospital, 6 school districts, and 12 local grocery stores participated in our survey. Of note, one of the 12 grocery stores were a large, local farmer’s market. Out of 12 local grocery stores, two were marketed as ethnic food stores. Additionally, five were a very small grocery store, having five or less employees. As mentioned above, no chain grocery store (e.g. Hy-Vee, Cub, Trader Joe’s, etc.) participated due to lack of contact information. All six Ramsey County ISDs participated in the survey. Additionally, Washington Co. ISD 831 and St. Paul Academy & Summit School took the survey. Washington Co. ISD 831 (Forest Lake) and St. Paul Academy & Summit School are *not* included the aggregated survey results. However, Washington Co. ISD 831 (Forest Lake) results are given in a case study in the Appendix section.

Survey Development

As mentioned above, the general purpose of the survey was threefold: 1) to assess stakeholder food

waste, donation, and composting, 2) to assess stakeholder barriers to food waste reduction, food donation, and composting, and 3) to assess stakeholder attitudes towards food waste reduction and donation efforts. To develop questions for the survey, we consulted the project objectives as set forth by the Economic Development Fellows team and Ramsey County. The two resources that were largely consulted for survey question development were 1) the Food Waste Reduction Alliance's (2014) *Analysis of Food Waste Among Food Manufacturers, Retailers, and Restaurants* survey, and 2) the barriers cited in the NRDC's (2017b) *Wasted-- How America is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill*. For additional research literature (resources and food waste studies) that was referenced, please see Appendix F. In particular, the EDF survey team focused on research literature that cited common barriers to either food donation, waste reduction, or composting.

Another important aspect of our survey was to create opportunities for business stakeholder engagement with Ramsey County. To that end, we included questions asking if any of the participants would be interested in connecting with Ramsey County to reduce/divert food waste from their institution. Ramsey County has already been provided with such a list of interested participants.

The final sections of the survey were:

1. Institution Demographics
2. Assessment of Food Waste & Food Donation
3. Barriers to Food Waste Reduction
4. Institution Thoughts on Food Waste & Food Donation
5. Ramsey County Engagement & Conclusions

All survey questions are given in the Appendix E. Additionally, we asked participants if they are willing to have their institution serve as a case study for Ramsey County. Information summarizing institutions willing to be a case study are given in the Appendix D.

Procedure

The survey was created in Qualtrics survey platform. Potential participants were given a link to the Qualtrics survey via email. Participant email correspondence was conducted via a Resilient Communities Project (RCP) University of Minnesota departmental email account. All participants

were given an option to give RCP their information to be in a \$50 Visa gift card raffle, if their institution allowed it, as a thank you for participation.

Local Grocery Stores. After gaining initial email contacts via phone, the EDF team sent an email to each contact. The email outlined the survey in more detail than what was given in the initial phone conversation and included the survey link. Follow up reminders to take the survey were sent weekly.

Schools. Ramsey County Independent School District (ISD) contacts were obtained through the Statewide Health Improvement Partnership Coordinator, Carissa Glatt. The contacts included the names and email addresses for the nutrition services coordinators (or related title) at each ISD. The EDF team sent an introductory email to each contact. The email introduced the project and invited participation but did not include the survey link. If the contacts responded with interest or requests for information, follow up was provided. Through this method, the survey link was sent out to 4 out of the 6 ISDs.

A second method was employed to increase the survey participation rate of Ramsey County hospitals and schools. At the November 29th, 2018 meeting of the School Recycling Advisory Group, a short statement was made regarding the survey by Rae Eden Frank, Ramsey County Environmental Supervisor. After the meeting, the link and information about the survey was sent out by Jodi Tatt, Founder & Principal Consultant at EcoConsilium, who was the meeting facilitator. Through this method, the two remaining Ramsey County ISDs took the survey.

Hospitals. Three contacts (names, emails, and job title) were provided by Ramsey County that were, in total, responsible for five of the hospitals in Ramsey County. Contacts were not obtained by the research group for United Hospital or Children's Minnesota. The EDF team sent an introductory email to each contact. The email introduced the project and invited participation but did not include the survey link. If the contacts responded with interest or requests for information, follow up was provided. Through this method, the survey link was provided to two of the three contacts; however, only one hospital took the survey.

Data Analysis

Data was analyzed for each stakeholder group in the final participant makeup using R, a program for statistical computing and graphics (<https://www.r-project.org/>). Most analyses were completed for each institution type, separately. Importantly, since only one hospital took the survey and the results were incomplete, the responses were dropped from data analysis due to identifiability issues; thus, only data from local grocery stores and Ramsey County K-12 schools public districts were analyzed. Summary statistics are given for each question, and any written responses were summarized. Institutions who gave consent to be a case study were analyzed and summarized qualitatively; results for such case studies are available in Appendix D.

Survey Results

Institution Demographics

Of the 18 total survey respondents, 33% ($n=6$) were K-12 school districts and 67% ($n=12$) were food retailers (see Figure 1). The six school districts surveyed served, on average, 11,092 students (median=8,850). School districts also had on average 105.17 food service employees (median=72.5). On average, food retailers in the survey had 39.5 employees (median=20).

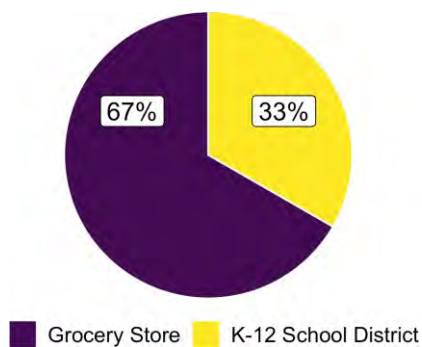


Figure 4. Survey Respondents by Institution Type.

Diagnosis of Discarded Food

Survey participants were asked several questions regarding how food products that are out of date, close to expiration, or have damaged packaging are handled at their institution.

Survey respondents were able to check multiple responses of what *sometimes* happens to that food (see Figure 5). Frequency or relative frequency of responses was not part of the survey question and should not be inferred.

Grocery Stores. Food that is out of date is cited by a majority of respondents to be ‘thrown out’ (58% of grocery store respondents indicated this response), ‘donated’ (58%), and ‘other’ (67%). The majority of ‘other’ responses for local grocery stores fit under the main categories: food given to employees or food is composted. Only 25% of grocery store respondents cited using or selling the food as a response.

For food close to expiration, 55% of respondents cited the response of using or selling the food and 55% also cited ‘other’ as a response. ‘Other’ responses to food close to expiration for local grocery stores were composting and price reduction. Donation was cited as a response by 36% of respondents. The smallest percentage of respondents, 18%, indicated ‘thrown out’ as a response to food close to expiration.

For food that has damaged packaging, the response cited by 50% of grocery store respondents was ‘other’. These ‘other’ responses were mainly that food is sent back to distributor/seller or some type vendor credit is provided. One respondent did indicate they reduced price or gave food to employees. Responses of ‘used or sold’ or ‘thrown out’ were each cited by 42% of respondents. Only 25% of respondents indicated ‘donation’ as a response to food with damaged packaging.

K-12 School Districts. Not surprisingly, none of the six K-12 school districts cited, as response to food that is out of date, using or selling. In fact, a majority of school districts (83%) cited that out of date food is ‘thrown out’ as a response. Two of the six school districts indicated that additional responses are donating the food or ‘other’. If K-12 school districts indicated an ‘other’ response, it was that the out of date food went to the food to hogs’ program.

For food that is close to expiration, 100% of school districts indicated using or selling the food as a response. Fifty percent of school districts indicated a response to be ‘thrown out’ and 50% also cited ‘other’ as a response. No K-12 school district provided a specific ‘other’ response. Only one of the six school districts surveyed indicated donation as a response to food close to expiration.

For food with damaged packaging, 67% of school districts indicated that ‘other’ was a response. One respondent indicated this food went to the pig bucket. Three respondents indicated something was worked out with their vendor either it is refused in the first place, it is returned to the vendor, or they get some type of vendor credit. Three of the six school districts indicated another response to damaged packaging was throwing it out. Fifty percent also indicated donation as a response. The smallest proportion of respondents, 17%, indicated that food with damaged packaging is ‘used or sold’.

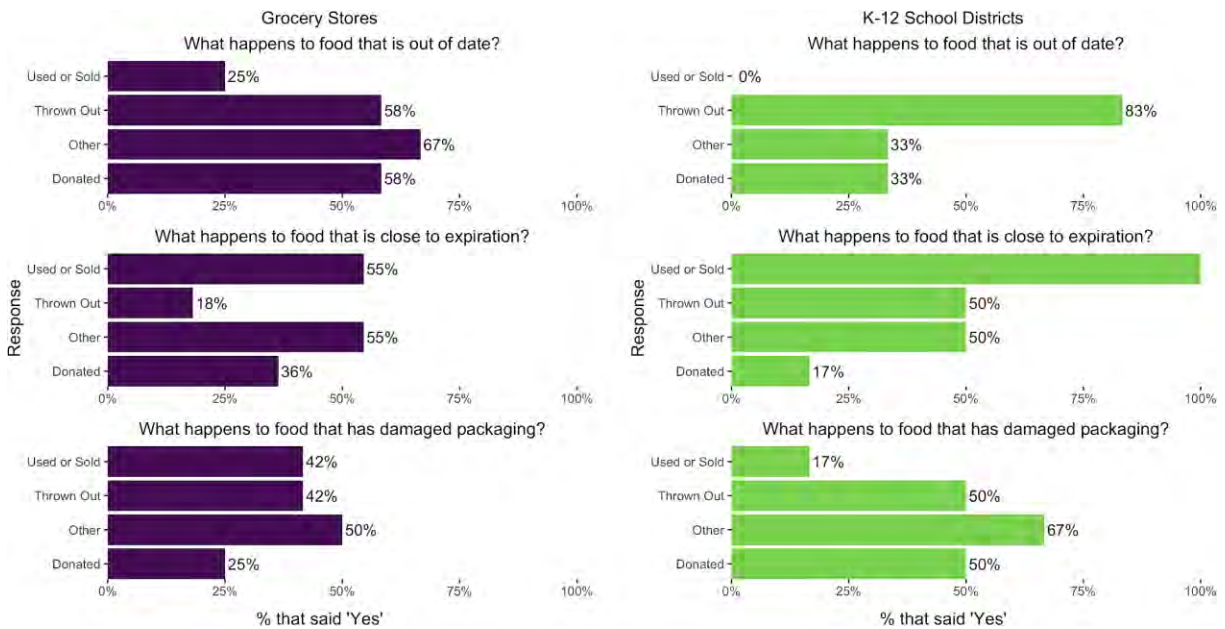


Figure 5. Responses to Out of Date, Close to Expiration, and Damaged Packing Food Products.

Note. Respondents could select as many responses as they saw fit from the options.

Survey participants were also asked about perceived causes of unsaleable food. Figure 6 displays the percentage of respondents that rated each cause (e.g., Food Expiration) listed as ‘not a cause’, ‘a minor cause’, ‘a moderate cause, and ‘a major cause’. By far, food expiration was rated the largest cause of unsaleable food amongst grocery stores (92% rated as a cause) and K- 12 school districts (100% rated as a cause) and was the largest *major* cause of unsaleable food amongst grocery stores (50%). Along similar lines, food that is almost out of date was indicated to be a cause by grocery stores (92%). Ugly produce was indicated by 25% of grocery stores to be a *major cause* of unsaleable food. Over ninety perK-12 school districts indicated that damaged packaging was a cause of the respondents that indicated ‘other’ to be a cause of unsaleable food, only two respondents provided what that ‘other’ cause is. A food retailer indicated “fresh produce, good till it starts to go bad” and a school district indicated “overproduction of food put on the service line” to be causes of unsaleable food.

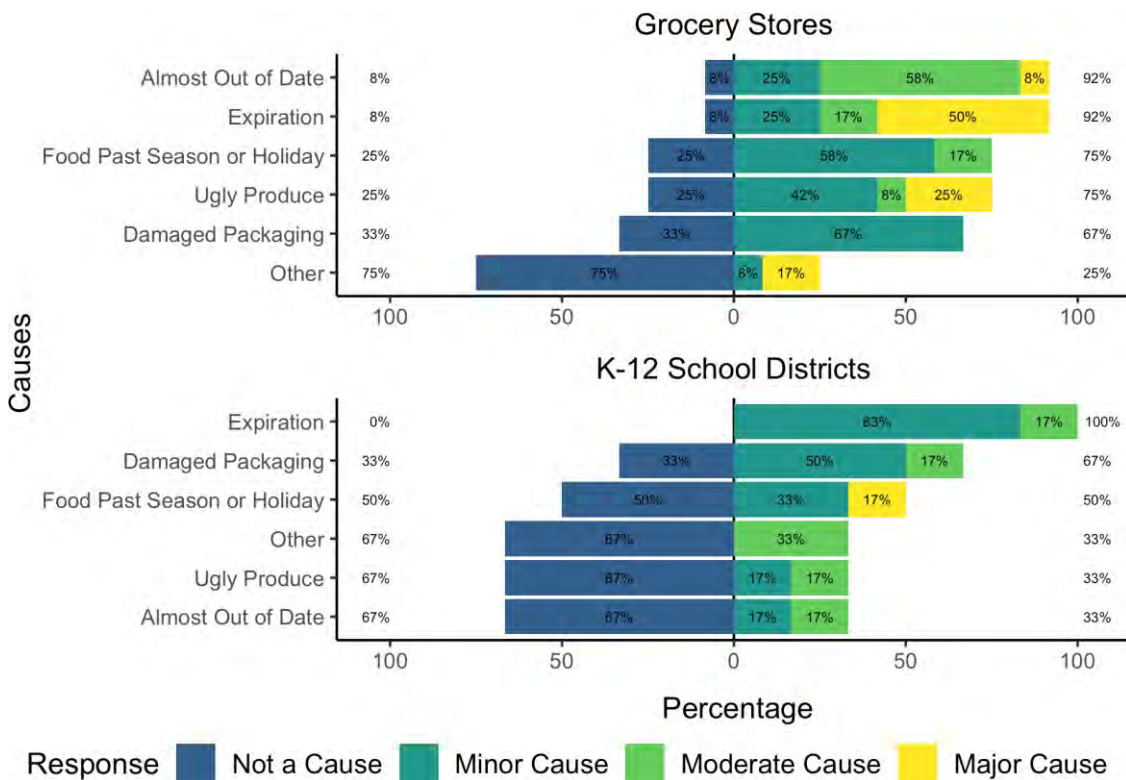


Figure 6. Causes of Unsaleable Food Amongst Survey Respondents

Survey participants were also asked to qualitatively evaluate which factors contribute most to food waste. The following summarizes and quotes responses from survey participants.

Grocery Stores. Commonly cited factors that contribute most to food waste included: expiration, damaged products, and the quality of produce (ugly or old). One respondent indicated a factor to be “The required [*sic*] from the county to have Ebt or wic”. Another respondent indicated several issues, “The biggest problem that continues to escalate are [*sic*] consumers not buying what they think is "ugly". Especially produce. Most of the time the produce is perfectly fine, but any imperfection gives the assumption that it is bad. The continued issues with farms have also made consumers more paranoid about what they buy. Sell by dates have also continued to scare consumers away. Each year sell/best by dates, especially in dairy products, are sooner resulting in more waste. There are no FDA regulations on *sell by*, *best by*, etc. dates. These companies are able to basically do whatever they want for dates and it is definitely leading to an absurd amount of waste.”

K-12 School Districts. Commonly cited factors that contribute most to food waste included: student food waste (e.g., over ordering, tray waste), as well as overproduction. One respondent indicated the following factors, “Not knowing how much to cook in a given day. We don't get counts at the secondary schools. There may be kids gone on a field trip and we were not notified.” Another respondent indicated these factors to be “TRAY WASTE, overproduction, staff putting out too many options on veggie bar lines, inaccurate forecasting/reference to past production records, students changing minds, introduction of new menu items (kids are unpredictable neophytes)”.

Diagnosis of Food Diverted

Food Bank/Shelf Donation. Of the grocery stores surveyed, 42% indicated that they do donate to food banks. Thirty-three percent of K-12 school districts donate to food banks. Grocery Stores donated to the following organizations food shelves/banks: Hallie Q Brown Community Center, Keystone Food Shelf, and Neighborhood House. School districts that responded indicated donating to: 12 Baskets and the Ralph Reeder Food Shelf.

Of all food donations, processed food was indicated to represent on average 46.2% of all grocery store donations ($n=5$, median=50%). For school districts, processed food was 15.5% of food donations ($n=2$). Survey participants were also asked which food types they had donated within the past year (non-processed food types) and this information is summarized in Figure 7. Six survey participants checked at least one box. Of institutions that donated one or more of the listed types of food, 100% donated vegetables, 100% donated fruits, ~67% donated whole grains, 50% donated dairy products, and only 33% donated meat.

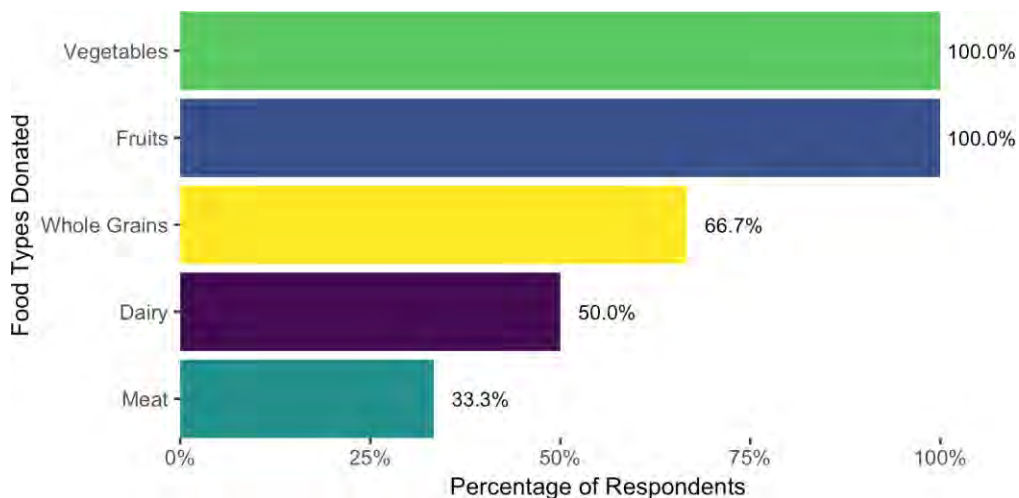


Figure 7. Donations of Non-Processed Food by Food Type.

Note: $n=6$; It was unknown if the respondents that didn't check a box indicating donation of any of the listed food types were abstaining from answering the question completely or if their answer was 'no' to donating any of the food types. With this ambiguity, the denominator for percentage of respondents was determined to contain only the six respondents that checked at least one box.

For institutions that indicated donating a particular food type (e.g. fruits), they were also asked to report what percentage of all food donated was this food type; respondent averages were computed for all food types. For grocery stores, on average, vegetables comprised 58% of all food donated (median=65.5%, $n=4$) and fruits comprised 30% (median=25%, $n=4$). Meat and dairy comprised only 11 and 30%, respectively, of all food donations ($n=1$). And whole grains represented on average 27% of food donations (median=20%, $n=3$). For K-12 school districts that indicated donating one or more types of food listed, vegetables on average comprised only 5.5% ($n=2$), fruits 6% ($n=1$), dairy 9.5% ($n=2$), meat 30% ($n=1$), and whole grains 40% ($n=1$) of food donated.

Quantification of Food Donation & Composting. The survey asked respondents several questions to obtain estimates quantifying food donated for human consumption, food donated for animal consumption, and food composted in an average month. Respondents could choose to report quantities in pounds per month, dollars per month, or report both measures.

Respondents were also asked to follow up questions to gauge their perceived accuracy of the reported estimate on a scale of 1 to 5; 1 was a 'best guess based on experience' and represented the lowest accuracy and 5 was 'based on actual recorded measures that are believed to be very accurate' and represented the highest accuracy.

Food Quantity Donated for Human Consumption*. On average, local grocery stores surveyed donated 2,244 lbs./month (median=1,000, $n=5$) for human consumption. The sole school district respondent indicated donation of \$1,000/month ($n=1$). When asked to rank the degree of accuracy of their estimate 60% of food retailers indicated the lowest level of accuracy 'best guess based on actual experience'. The remaining 40% indicated one of the two highest levels of accuracy 'based on actual recorded measures'. The sole school district respondent indicated a medium accuracy level.

Quantity Donated for Animal Consumption*. On average, local grocery stores surveyed donated 731.1 lbs./month with the median being 30 lbs./month ($n=9$) for animal consumption.

Local grocery stores donated, on average, ~\$274/month ($n=6$, median=\$200). Four of the grocery stores reported both pounds and dollar estimates, one grocery store indicated zero in both cases.

School districts donated, on average 21,667 lbs./month ($n=3$, median=15,000) and

\$2,333/month ($n=3$, median=\$2000). Only one school district reported both pound and dollar estimates and both were zero. Of grocery store respondents (either lbs./month or \$/month), ~42% indicated the lowest level of accuracy in their estimate, however another ~42% indicated the highest level of accuracy in their estimate. Of school districts, 60% indicated having the lowest level of accuracy in their estimate.

Quantity Composted.¹ On average, local grocery stores surveyed composted 4,746 lbs./month with the median being 500 lbs./month ($n=9$). Grocery stores, on average, composted ~\$360/month with the median being \$50/month ($n=5$). Three grocery stores reported both pounds and dollar estimates, however two of these were estimates of 0 pounds/month and \$0/month. School districts, on average, composted 0 lbs./month ($n=3$) and one indicated composting \$3,000/month ($n=1$). No school district reported both pound and dollar estimates. Around 54% of food retailers indicated the lowest accuracy level for their estimate, while 75% of school districts indicated the highest level of accuracy in their estimate; estimates with this highest accuracy were zero pounds/month

Food Waste & Donation Attitudes

Commitment to Reducing Food Waste. Overall, all grocery stores viewed reduction of food waste as important to their institutions. Reduction of food waste was cited as *extremely* important to 58.3% of grocery stores, *very* important to 33.3% of grocery stores, and *moderately* important to 8.3% of grocery stores. Additionally, 91.7% of grocery stores indicated that they have an expressed commitment to reducing food waste; 91.7% of grocery stores also sell items close to expiration date at a reduced rate.

Overall, all K-12 school districts viewed reduction of food waste as important to their institutions. Reduction of food waste was cited as *extremely* important to 16.7% of school districts and *very* important to 83.3% of school districts. Additionally, 66.7% of school districts indicated that they had an expressed commitment to reducing food waste; 16.7% indicated they did not have expressed commitment, and 16.7% abstained from answering whether or not they had an expressed commitment.

Incentives to Catalyze Increased Food Donation. As a part of our section assessing attitudes toward food waste reduction and donation, we also asked institutions to select possible incentives that may catalyze their institution to donate more unsaleable/unusable food (see Figure 8). The most endorsed incentives to increased donation cited by local grocery stores were strengthening of the store's relationship with local businesses and nonprofits (50% endorsed), reduction of the cost of

¹ Responses to these questions may have faced confusion over units. While the survey asked for monthly numbers, respondents indicated different units occasionally in their responses (e.g. per week, per year). It may be possible too that respondents put a number that was, for example, yearly without indicating those units, thus we have discussed the possibility that some numbers may be overestimates.

discarding food waste (50% endorsed) and strengthening of the store’s employee engagement and culture (41.7% endorsed). The most endorsed incentives to increased donation cited by K-12 schools were reduction of the cost of discarding food waste (66.7% endorsed) and strengthening of employee engagement/culture (50% endorsed).

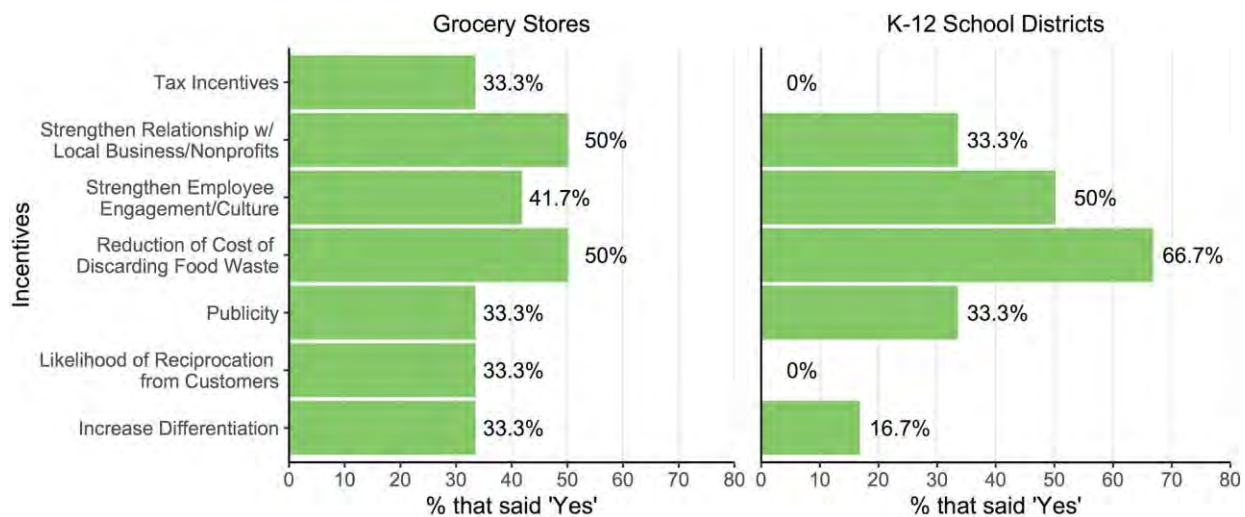


Figure 8. Percent of Respondents that Indicated the Incentive Listed May Increase Food Donation for Their Institution

Selling and Using “Ugly” Produce. Lastly, we asked about whether or not grocery stores sell “ugly” produce in their store and/or uses “ugly” produce in their pre-made dishes, as use of “ugly” produce provides an excellent avenue to reduce food waste. We found that 41.7% of grocery stores sell ugly produce and 50% of grocery stores use “ugly” produce in their premade dishes. Only 33.3% of school’s districts used “ugly” produce in their dishes, both of which indicated that they use the pre-pack and reheat method (rather than cooking food from scratch). Schools were not asked about selling “ugly” produce (but they were asked to rate ugly produce as cause of unsaleable food; see Figure 6).

Barriers

One of the larger goals of the present survey was to assess the barriers that Ramsey County local grocery stores and K-12 school districts face when attempting to a) reduce food waste, b) donate food, and c) compost food/organics. In the survey, participants were given a list of barriers (e.g., sales fluctuations, knowledge, overproduction of prepared food, etc.) and asked to rate each item on the list on a scale, with 1 = ‘not at all a barrier’, 2 = ‘a small barrier’, 3 = ‘a common barrier’, 4 =

‘an extreme barrier’. Individuals were also allowed to select “Unknown”. Grocery stores and K-12 school districts were given slightly different lists of barriers due to institutional differences (e.g., “students taking large portions” does not make sense for a grocery store barrier). Figures 9-11 list all barriers asked about, further description of barriers can be found in Appendix E if not already stated in the results section below.

Barriers to Food Waste Reduction.

Local Grocery Stores. Overall results on barriers to food waste reduction for grocery stores are outlined in Figure 9. The top barriers to food waste reduction cited by grocery stores in order were sales fluctuations (e.g., bad weather or other unpredictable factors make inventory planning difficult; 100% cited), expiration date labels (e.g. still consumable foods removed from shelves because they are close to the expiration date; 83% cited), packing & packaging (e.g. packing methods that affect shelf life, packing where grouped products need to be discarded if one item goes bad, inflexible case sizes, etc.; 75% cited), staffing challenges (e.g., not enough staff to prepare food/rotate stock, poor training for handling food, etc.; 75% cited), promotional products (e.g., failure of promotional/holiday food items to sell; 75% cited), and forecasting errors (75% cited). When taking a closer look at barriers that were cited as “a common barrier” or “an extreme barrier” only, the top barriers cited for grocery stores were sales fluctuations (50% cited as common to extreme), expiration date labels (50% cited as common to extreme), overproduction of prepared food (42% cited as common), and knowledge about the best ways to reduce food waste (36% cited as common). Overall, it appears that sales fluctuations and expiration date labels pose as the largest perceived barriers to food waste reduction for the grocery stores. Additionally, one grocery store notified us of a barrier under the “other” option; they listed “weather, growing season” as an extreme barrier toward the reduction of food waste. They did not specify what is was about the weather/growing season that caused problems for the reduction of food waste.

K-12 School Districts. Overall results on barriers to food waste reduction for K-12 school districts are outlined in Figure 9. The top barriers to food waste reduction cited by K-12 school districts were students taking larger portions than they can eat (100% cited as barrier),

lunchroom restrictions (e.g. lack of practices that encourage lunch to be eaten, lack of well-timed lunch periods, not allowing students to choose components of meals, etc.; 100% cited as barrier), overproduction of prepared food (100% cited as a barrier), expansive menu options (e.g. extended menu options that complicate inventory management and require more ingredients to be kept on hand; 100% cited as a barrier), expiration date labels (e.g., food not used because it is close to its expiration date; 83% cited as a barrier), stock management (e.g., large inventory, full shelves, improper stock rotation, etc.; 83% cited as a barrier), staffing challenges (e.g. not enough staff to prepare food/rotate stock, poor training for handling food, etc.; 83% cited as a barrier), and forecasting errors (83% cited as a barrier). When taking a closer look at barriers that were cited as “a common barrier” or “an extreme barrier” only, the top barriers cited are students taking larger portions than they can eat (67% cited as common to extreme), lunchroom restrictions (50% cited as common), overproduction of prepared food (50% cited as common), and forecasting errors (50% cited as common). Of note, 50% of the school districts cited students taking larger portions than they can eat as an extreme barrier. Overall, it appears that students taking large portions poses as the largest perceived barrier to food waste reduction for K-12 school districts. Additionally, one school district notified us of a barrier under the “other” option; they listed “students required to take things they don’t like” as an extreme barrier toward the reduction of food waste.

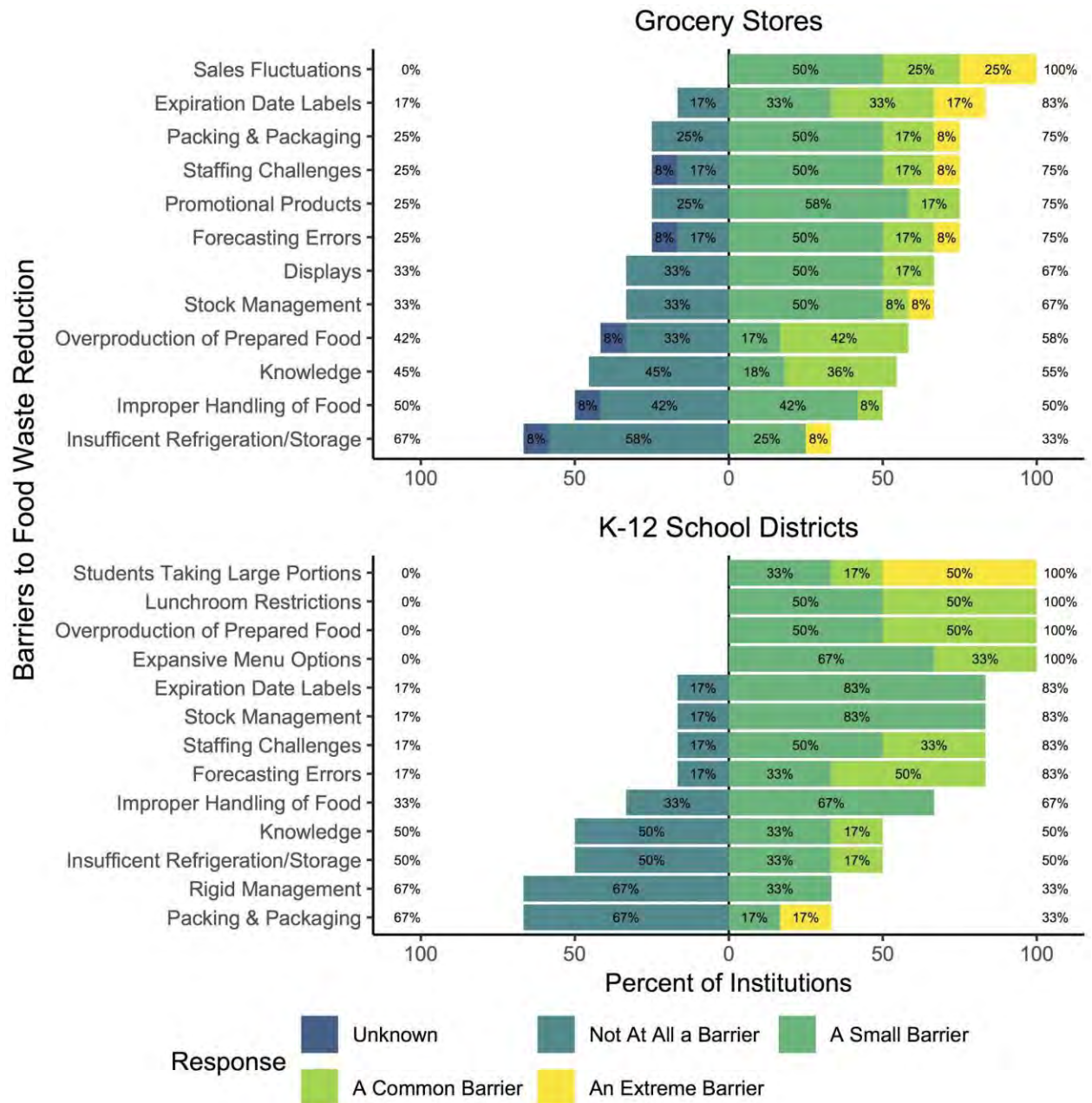


Figure 9. Responses to Barriers to Food Waste Reduction by Institution Type

Barriers to Donation.

Local Grocery Stores. Overall results on barriers to food donation for grocery stores are outlined in Figure 10. The top barriers to food donation cited by grocery stores were time constraints (67% cited), transportation constraints (e.g., distance, fleet, etc.; 58% cited), legal liability concerns (58% cited), and knowledge about best ways to donate unsaleable food (55% cited). When taking a closer look at barriers that were cited as “a common barrier” or “an extreme barrier” only, the top barriers

cited are legal liability concerns (50% cited as common to extreme), knowledge about best ways to donate unsaleable food (36% cited as common to extreme), insufficient refrigeration/storage at the food bank (36% cited as common to extreme), and time constraints (33% cited as common).

K-12 School Districts. Overall results on barriers to food donation for K-12 schools are outlined in Figure 10. The top barriers to food donation cited by grocery stores were time constraints (100% cited), legal liability concerns (100% cited), knowledge about best ways to donate unusable/unsaleable food (83% cited), transportation constraints (e.g., distance, fleet, etc.; 83% cited), and improper refrigeration/storage on site (83% cited). When taking a closer look at barriers that were cited as “a common barrier” or “an extreme barrier” only, the top barriers cited are knowledge about best ways to donate unusable/unsaleable food (67% cited as common to extreme), transportation constraints (66% cited as common to extreme), legal liability concerns (50% cited as common to extreme), and time constraints (50% cited as common).

Legal liability. One of the larger barriers to food donation mentioned for both local grocery stores and K-12 school districts were legal liability concerns. As a part of our survey, we asked institutions if they were aware of the Bill Emerson Good Samaritan Food Donation Act (1996), which reduces the liability of institutions that donate food in good faith. Only 25% of grocery stores were aware of the act. However, after getting information on/reading through the act, 66.7% of grocery stores who were initially unaware indicated that their newfound knowledge of this act would increase the likelihood of their institution donating food. Only 50% of school districts were aware of the act. After getting information on/reading through the act, one out of the three (33.3%) K-12 school districts who were initially unaware indicated that their newfound knowledge of this act would increase the likelihood of their institution donating food.

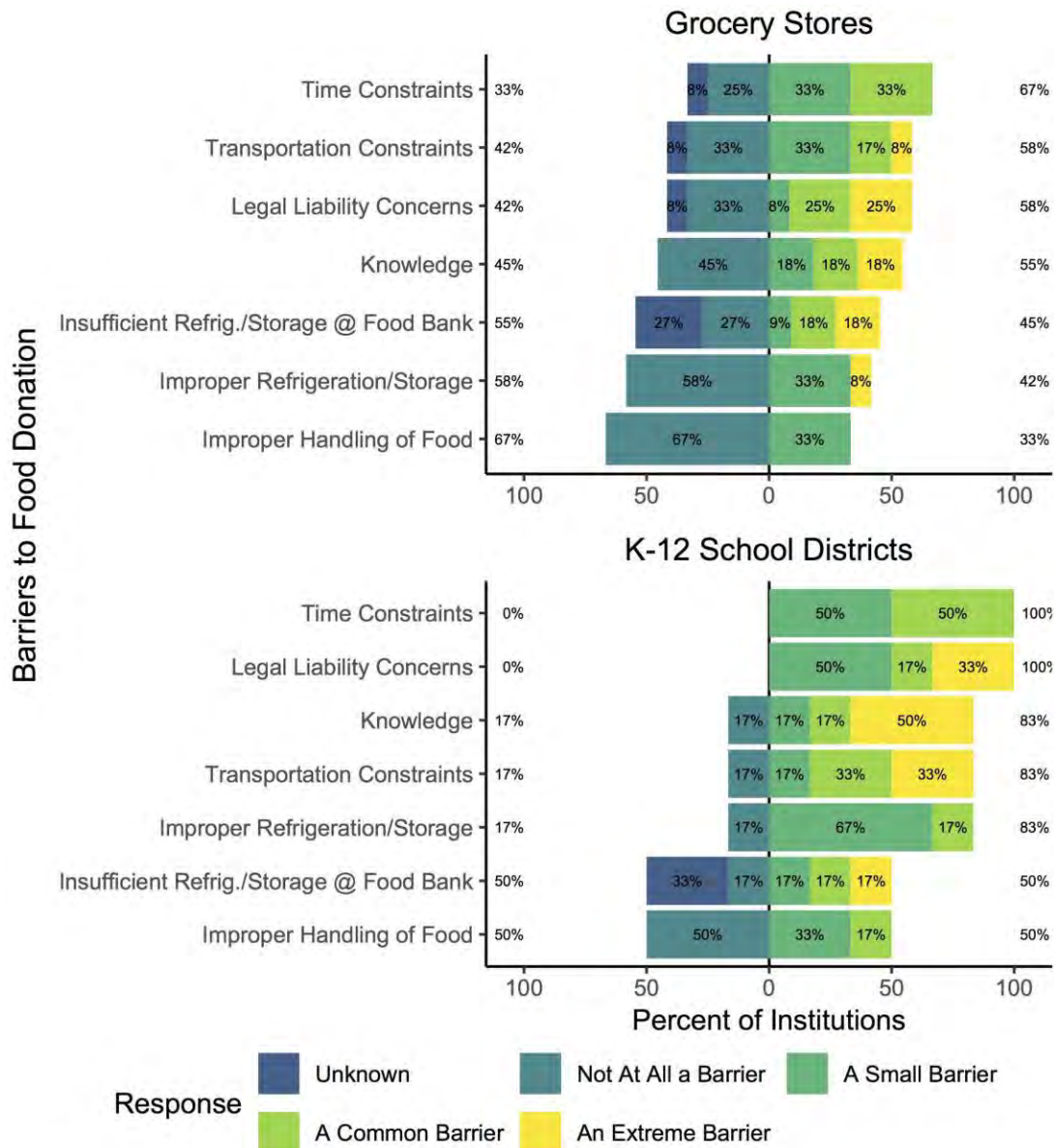


Figure 10. Barriers to Food Donation by Institution Type

Barriers to Composting.

Local Grocery Stores. Overall results on barriers to composting for grocery stores are outlined in Figure 11. The top barriers to composting cited by grocery stores were knowledge about best ways to recycle food waste and organics (58% cited) and monetary cost (58% cited). When taking a closer look at barriers that were cited as “a common barrier” or “an extreme barrier” only, the top barrier cited was monetary cost (34% cited as common to extreme).

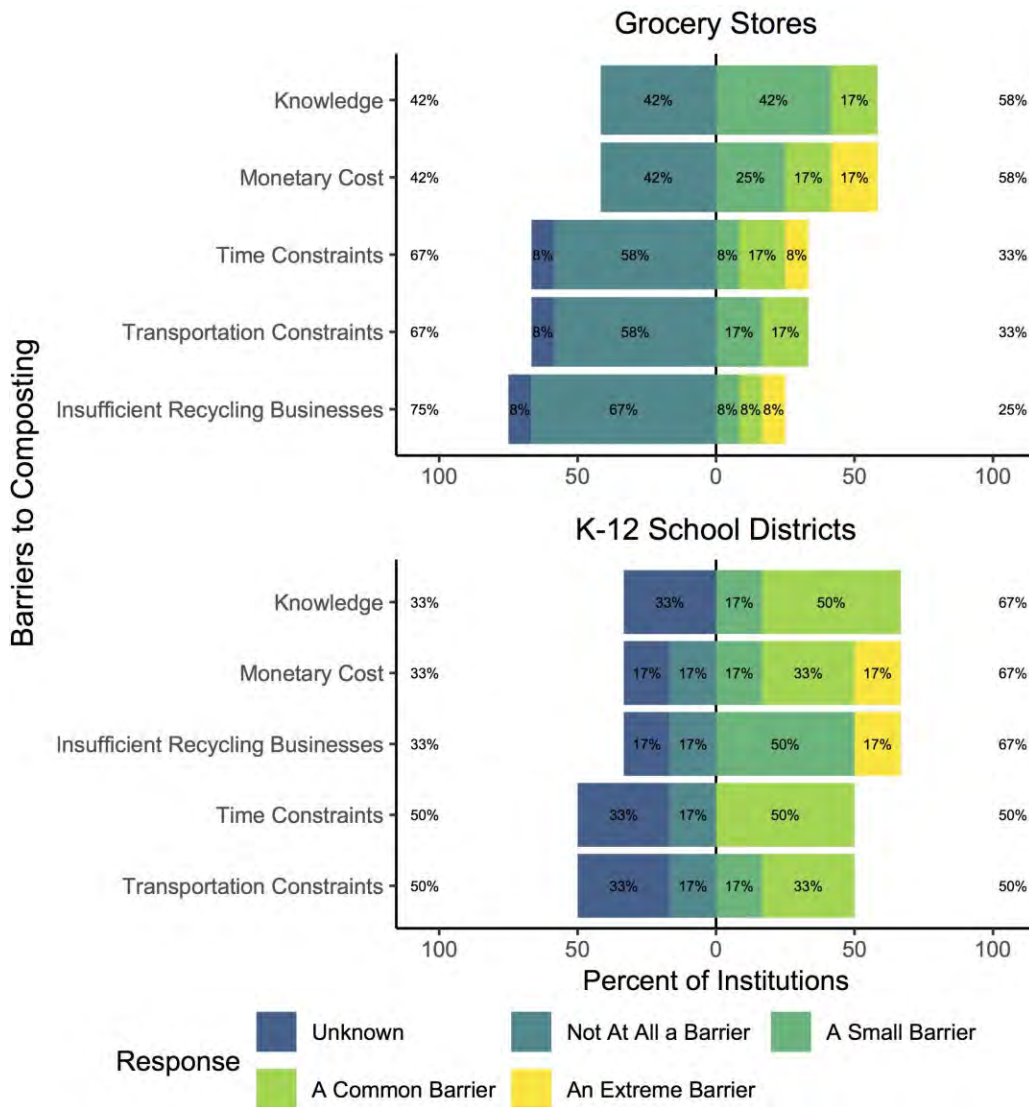


Figure 11. Barriers to Composting Food Waste and Other Organics by Institution Type

K-12 School Districts. Overall results on barriers to composting for K-12 schools are outlined in Figure 11. The top barriers to composting cited by grocery stores were knowledge about best ways to recycle food waste and organics (67% cited), monetary cost (67% cited), and insufficient recycling businesses in the community (67%). Additionally, time constraints and transportation costs (e.g., distance, fleet, etc.) were still cited as a barrier for 50% of institutions. When taking a closer look at barriers that were cited as “a common barrier” or “an extreme barrier” only, the top barriers cited were monetary cost (50% cited as common to extreme), knowledge about the best ways to recycle food waste and organics (50% cited as common), and time constraints (50% cited as common). Additionally, one school district notified us of a barrier under the “other” option; they

listed “expensive bags to compost, smelly dumpsters, weight of compost for someone to lift in a dumpster” as an extreme barrier to composting food and organics.

Ramsey County Engagement

A section of the survey posed questions on Ramsey County engagement. Survey respondents were asked about their interest in connecting with Ramsey County to reduce/divert food waste. Overall 50% of respondents were interested in connecting ($n=16$), four school districts and four local grocery stores indicated ‘yes’.

Survey respondents were also asked about their knowledge of BizRecycling. Of all respondents, 37.5% knew about BizRecycling, 37.5% were unsure, and 25% did not know about BizRecycling ($n=16$). Five of the grocery stores (that had responded) responded affirmatively that they knew about the program, whereas only one of the six school districts did. For the school districts, three of the six did *not* know about the program. Use of BizRecycling was low only 1 respondent indicated using (~6%), 5 were unsure (~31%), and 10 did not use (~63%). A school district indicated affirmatively that they used BizRecycling. See Figure 12 below for the conditional results displayed graphically.

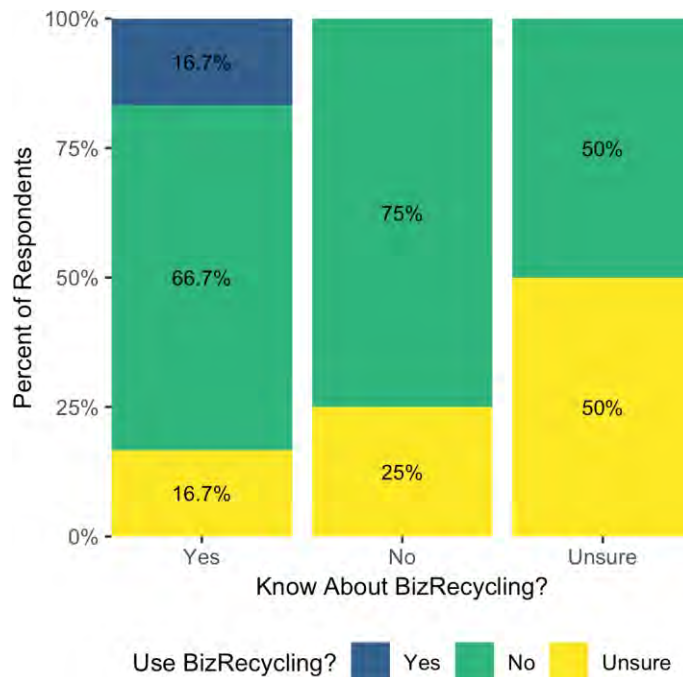


Figure 12. BizRecycling Knowledge and Use Among Survey Respondents

School Specific Questions

In our survey, we also asked questions about situations that are uniquely encountered in K-12 school districts. School districts were each asked to specify what percent of their food waste is caused by their own food preparation and management versus children not eating the food that they take. Overall, schools overwhelmingly cited children not eating food as a larger proportion of their food waste (mean = 78.33%, median = 82.5%, SD = 14.38%) than food preparation and management (mean = 21.67%, median = 17.5%, SD = 14.38%). Despite this fact, it is interesting to note that only two out of the six school districts (33.3%) specified that they make their students aware of the implications of food waste and actively encourage their students to eat their whole lunch. Schools that make their students aware of the implications of food waste cited classroom training and education as their means to make students aware. These schools also encouraged their students to eat a whole lunch through reminders from lunch staff and through teaching and conversation in the classroom.

School districts were also asked more specific questions about the lunchroom and lunch requirements. Fifty percent of school districts indicated that they do require students to pick food from each food group. A slightly higher 67% of school districts indicated that they have trade tables (aka “share tables”) for students to trade unwanted food items. Fifty percent of school districts indicated using “smarter lunchroom”² techniques such as serving at least two types of fruit or using creative food names. When it comes to food service, 67% of school districts indicated most food is self-service, while the remaining 33% indicated some food is self-service. Four respondents indicated which items are self-service; items cited by at least two districts to be self-service were fruits, vegetables, beverages, and salads. An even split, 50% of school districts indicated using a prepack and reheat method for school lunch, while the other 50% indicated cooking from scratch.

Discussion of Survey Results

What Institutions Are Doing Well

Survey results indicate that the institutions surveyed, local grocery stores and K-12 school districts, are exhibiting attitudes and taking certain actions that are positive in regard to food donation and

² Survey linked to participants the Smarter Lunchroom website which provided all 60 strategies.
<https://www.smarterlunchrooms.org/scorecard-tools/smarter-lunchrooms-strategies>

food waste reduction. For example, 42% percent of institutions surveyed donate food to food banks/shelves. While this number could be higher and doesn't indicate quantity or frequency of donation, it is favorable to see that efforts are being made to donate food by well over a third of the respondents. Another positive result was that institutions, for the most part, are not only donating processed foods in the past year but also donate fruits and vegetables. Fresh produce is important to stock at food shelves because of the high demand and its nutrient content. Of the seven respondents indicating they did donate food within the past year, only one donated 100% processed foods; the remaining six all donated fruits and vegetables.

Attitudes toward food waste are also very good across both groups of stakeholders. All institutions saw reducing food waste as important to their institution, with a vast majority indicating the reducing food waste is *very to extremely* important to their institution. Around 92% of grocery stores and 67% of schools indicated that they had an expressed commitment to reducing food waste.

Respondents also indicate that food that is out of date, close to expiration, or has damaged packaging is not just always thrown away; institutions are recognizing, and sometimes using, other responses such as donating the food, using/selling, composting, giving to employees, or returning for vendor credit, amongst other responses. This is a satisfactory result to see; While institutions aren't just throwing out these types of food, it is unknown the relative frequency with which each of these responses may be employed. There is likely potential to reduce the frequency of throwing out the food that is out of date, close to expiration, or has damaged packaging.

Local Grocery Stores. Price reduction is a tool sometimes used to deal with food that is *close to expiration*. While many individuals have likely seen this tool used in chain grocery stores, it is positive to see that is also used in our sample of small local grocery stores. It is not clear, however, if price reduction for food close to expiration is easier to implement for these non-chain stores, nor how effective it is. Giving food to employees is sometimes used as a tool to deal with *out of date* food. This response was interesting to see because it may be particularly characteristic of our sample. With small stores, it is likely easier to give employees *out of date* food, as there are no corporate rules or procedures preventing this.

K-12 School Districts. There were several interesting results in terms of what the school districts responded as causes of unsaleable food. Interestingly, school districts seem to feel that food that is

almost out of date is not a major cause of unsaleable food. Sixty-seven percent of respondents indicated it was *not* a cause. The remaining 33% said it was only a minor to moderate cause. It is likely that up until the expiration date the food is still sold. This is supported by case study of Forest Lake ISD 831 (Washington County) indicating school districts may push heavily to sell items close to expiration. It could also be the case that kids don't pay great attention to expiration dates, making the aforementioned practice effective.

School districts also appear to be doing a decent job of mitigating ugly produce as a potential cause of unsaleable food. Sixty-seven percent of respondents indicated it was not a cause and 33% indicated ugly produce was a minor to moderate cause. Perhaps this is because students may receive prepared food that is chopped or cut up into pieces already. It is less difficult to be objectionable to blemishes on produce if you can't see them anymore. However, this is only one hypothesis. It is also important to point out we do not know the percentage of school districts that actually sell ugly produce. It could be the case that school districts filter out the blemished/ugly produce before selling to kids. Overall, school districts may be doing a satisfactory job of mitigating this potential cause of unsaleable food.

What Institutions Could Improve Upon

While institutions exhibit positive attitudes towards reducing food waste and employ some tools to reduce food waste, there is great potential to improve both food donation and food waste reduction practices amongst local grocery stores and K-12 school districts in Ramsey County.

Donation. Firstly, donation of food past its expiration date label should increase and management of food approaching expiration needs to improve. Only 58% of local grocery stores and 33% of K-12 school districts donated any quantity of foods that were past the expiration date label, whatsoever. There are certain foods that can be donated and consumed past the expiration date, such as foods kept continuously frozen. Additionally, food products usually don't have an 'expiration' date but have, instead, a *sell by*, *best by*, or *use by* date; food that is past the *sell by* or *best by* dates are often still acceptable to donate. There can be great confusion over the differences between these labels; federal regulations only require product dating for infant formula, but states may have various, distinct food dating regulations. In evaluating which factors contribute most to food waste, one grocery store said "*There are no FDA regulations on sell by, best by, etc. dates. These*

companies are able to basically do whatever they want for dates and it is definitely leading to an absurd amount of waste”. While an opinion, this quote sums up well the date labeling confusion.

Additionally, donation of food with damaged packaging should increase. Only 25% of local grocery stores and 50% of K-12 school districts donated any quantity of food with damaged packaging. Donation of foods with minimal/non-compromised damaged packaging are often still accepted by food shelves. All grocery stores see damaged packaging as a minor cause of unsaleable food; Sixty-seven percent of school districts see this as a minor to moderate cause of unsaleable food. While schools and grocery stores have options with damaged food that is delivered to them (e.g., vendor credit or return to distributor), they ought to consider donating food items that become damaged after delivery, if appropriate.

Lastly, grocery stores and school districts should donate more meat and dairy food products. Of institutions that donated one or more of the listed types of food (i.e., vegetables, fruits, meats, dairy, whole grains), only 50% donated dairy products and only 33% donated meat in the past year. Because of the limitations of our survey questions, the specific quantity of these items that are donated is unknown. Grocery stores in our sample may not sell, or sell in low quantities, these product types. Of note, legal liability concerns for these food products may be high and education may help increase donations (even by just a small amount) of meat and dairy, which are often in high demand at food shelves.

Reduction of Food Waste. Institutions could help reduce food waste through many practices. One practice would be increasing use of BizRecycling, which can help institutions improve food recovery and set up organics recycling. Use of BizRecycling was low; only 1 respondent indicated using BizRecycling (~6%), 5 were unsure (~31%), and 10 did not use BizRecycling (~63%). The one user of BizRecycling was a school district. Another important practice to support reduction of food waste is the need to measure and account for the amount of food donated, composted, donated for animal consumption, and wasted. We saw great variability in accuracy of reported estimates of, for example, amount of food composted monthly, amongst others. Understanding an institution’s current measurements provides a benchmark to track progress over time and helps identify what practices may or may not be working to reduce food waste. Lastly, expiration date labels were cited as common to extreme barriers to food waste reduction by 50% of grocery stores and as a small

barrier by 83% of school districts. Thus, addressing this barrier is key. It should be noted, however, that we cannot be 100% sure if respondents are referring to the expiration of food itself or expiration date labeling when they note “expiration date labeling” as a barrier. Each of these more specific barriers would require different management approaches.

Local Grocery Stores. The following are suggestions for local grocery stores.

Specifically, local grocery stores:

- (1) Should focus on managing the largest causes of unsaleable food: food that is expired or almost out of date, food past holiday/season, and ugly produce. Only around 42% of grocery stores sell ugly produce, and only 50% use ugly produce in their pre-made dishes.
- (2) Ought to donate more to food banks. Only 42% did donate to food banks. Main barriers cited were legal liability, knowledge, transportation, and time constraints.
- (3) Manage top barriers to food waste reduction: sales fluctuations, expiration date labels, overproduction of prepared food, and understand the best ways to reduce food waste.
- (4) Use better composting practices or begin to compost. Efforts should be made to obtain awareness of the best ways to recycle food waste and organics and focus should be placed on finding resources to reducing the monetary cost of composting.

K-12 School Districts. The following are suggestions for K-12 school districts.

Specifically, K-12 school districts:

- (1) Should balance priorities of encouraging healthy nutrition and reducing food waste. Schools ought to use ugly produce in prepared meals. None of the school districts that cook food from scratch used ugly produce in prepared meals. Schools ought to use practices that better manage the top barriers to reducing food waste: students taking large portions, overproduction, lunchroom restrictions, and forecasting errors. Two easy ways that the barrier, “students taking large portions”, could be reduced is to make students aware of the implications of food waste and encourage students to eat a full meal (only 33% of districts currently did this).
- (2) Donate more to food banks. Only 33% of school districts donated. In order for schools to donate more, the main barriers to donation - knowledge, time constraints, refrigeration, legal liability concerns, and transportation - must be addressed. One way to help manage liability

concerns is to make school districts aware of the Bill Emerson Good Samaritan Food Donation Act (only 50% knew about it).

- (3) Compost when appropriate. Only one of school districts reported that they currently compost. Knowledge and money are seen as major barriers to composting. Focus on obtaining these resources is key.

Recommendations

Survey results give ideas of the actionable steps that Ramsey County should take to reduce food waste and divert food toward donation within their community and in specific partnership with the local grocery and K-12 school districts. Below, the researchers have divided these steps into 1) what Ramsey County Public Health should *provide* to combat common barriers cited by their stakeholders³ toward food waste reduction, food donation, and composting, 2) how Ramsey County Public Health should *educate* the stakeholders, and 3) what Ramsey County Public Health should do to *encourage* food waste reduction and donation within their stakeholders.

PROVIDE	<ul style="list-style-type: none"> → Education about food waste reduction, food donation, and food composting → Options to reduce the time and transportation constraints of food donation → Options to reduce the monetary cost of recycling
EDUCATE	<ul style="list-style-type: none"> → Actively educate stakeholders on steps of food donation processes → Actively educate stakeholders on organics recycling process → Educate survey stakeholders on what they need to know about legal liability when donating food → Educate survey stakeholders on the financial benefits of food/organics recycling and grants they can receive → Give local grocery stores guidelines for food waste reduction
ENCOURAGE	<ul style="list-style-type: none"> → Use of methods that facilitate food waste/food donation management, such as consulting services or software/apps, especially within local grocery stores → Use of “ugly” produce and marketing “ugly” produce in an appealing way → School districts to educate their students about the implications of food waste and encourage their students to eat a full lunch → Measurement of food wasted and donated

³ Stakeholders in the following sections for recommendations are defined as local grocery stores and K-12 schools districts.

What Ramsey County Public Health Should Provide:

- 1. Education about food waste reduction, food donation, and food composting.** This recommendation is supported by our finding that “knowledge about best ways to donate unsaleable food” and “knowledge about best ways to recycle food waste and organics” were a few of the top barriers cited to food donation and food/organics recycling, respectively. Additionally, there are some topics that were cited as barriers to food waste reduction that education may help with, such as “packing and packaging” for grocery stores. Specific topics that the researchers believe would be the most helpful for Ramsey County Public Health to educate their stakeholders on are provided in the “How Ramsey County Public Health Could Educate” section below.
- 2. Options to reduce the time and transportation constraints of food donation.** Other than knowledge, other preeminent barriers to food donation cited by both groups of stakeholders included time and transportation constraints. Thus, increasing options for institutions to reduce the time and transportation constraints of food donation (and knowledge of these options) may provide an increase in food donation participation, or an increase in the amount of food donated, among survey stakeholders.
- 3. *Ramsey County Public Health should consider providing coordination of volunteers for food donation pick-up/drop-off.*** One of the most endorsed incentives institutions cited to increase the likelihood of their donation was a “strengthening of employee engagement and culture”. Thus, facilitating the development of groups of employee volunteers or community members (such as the PTA for school districts) for both local grocery stores and K-12 school districts would provide a method of increasing food donation and reducing time/transportation constraints of the institution itself, while strengthening employee engagement and culture. Some methods that Ramsey County Public Health could use to facilitate these groups could be hosting a website that connects individuals interested in volunteering for such a project, holding information sessions on how to form your own volunteer group, or locating activists in each organization and training them. However, one barrier to this would be finding employees / community members willing to volunteer on a semi-regular basis. Another highly endorsed incentive of increasing likelihood food donation cited by local grocery stores was “strengthening of relationship with local businesses/nonprofits.” One method in which to do this would be for Ramsey County Public Health to provide initial connections between local grocery stores and food donation

nonprofits or food banks, such as Second Harvest Heartland, Keystone Community Services, Francis Basket Food Shelf, etc.

- 4. Options to reduce the monetary cost of recycling.** Ramsey County Public Health should consider a program like “Love Food Not Waste” in Eugene, OR (see Section IV) that reduces businesses’ food waste recycling services by 20% and allows businesses to receive free training from the city. Additionally, if it is Ramsey County may find it beneficial to allow smaller, “corner” grocery stores to obtain free recycling caddies as done for local residents. Finally, although not education per se, a larger, more drastic step toward increased recycling of food/organics would be to eventually set an organic waste diversion/recycling requirement for businesses (see Austin, TX and San Francisco, CA examples in Section IV: Strategy 4 for more details).

How Ramsey County Public Health Should Educate:

- 1. Actively educate stakeholders on steps of food donation processes.** Knowledge about the best ways to donate food was cited as a leading barrier to food donation by both local grocery stores and K-12 school districts. One method that Ramsey County Public Health can use to fill this knowledge gap is by *providing the following educational resources in a singular, easy-to access location and format*: (1) prepared food donation guidelines, (2) date label guidelines for donation, (3) types of food that can be donated and what is most in need, and (4) foods with damaged packaging that can still be donated, as survey results indicated that these resources would help most. The researchers envisage most of these guidelines should aim to be general, as specific requirements may differ across various area food shelves. While the researchers envisaged factsheets that are printable and stored under one major webpage, other options for distribution/storage do exist such as Google Drive/Dropbox and an email list that pushes out information. Additionally, Ramsey County Public Health could provide a list and/or publish online a map that contains all the food shelves/banks in the area.
- 2. Actively educate stakeholders on organics recycling process.** Knowledge about the best ways to compost/recycle food waste and organics was cited as a main barrier toward recycling food/organics by both local grocery stores and K-12 school districts. Ramsey County Public Health should educate survey stakeholders on food/organics composting, education may include local options for composting, types of food and other organics that can be composted, organics drop-off sites, and methods to reduce monetary costs associated

with recycling. Of course, an essential component of this education would be for Ramsey County to actively educate their stakeholders by providing them with information. While some of the information mentioned above is online and available for stakeholders, it is clear that there is a disconnect between information being provided and stakeholders actually receiving the information.

- 3. Educate survey stakeholders on what they need to know about legal liability when donating food.** Legal liability was noted as a common to extreme barrier for 50% of both local grocery stores and K-12 school districts. Of interest, when asked about the Bill Emerson Good Samaritan Food Donation Act (1996), only 25% of grocery stores and approximately 33% of K-12 school districts were aware of the act. Of grocery stores that were initially unaware of this act, 67% indicated that their newfound knowledge increased the likelihood of their institution of donating food; 33% of initially unaware K-12 school districts said the same. Furthermore, having information available to stakeholders that outlines both the Bill Emerson Good Samaritan Food Donation Act (1996) and other legal liability issues associated with food donation in an *easily readable and digestible* manner (i.e., no legalese) may significantly help stakeholders' understanding of the issues surrounding legal liability with food donation.
- 4. Educate survey stakeholders on the financial benefits of food/organics recycling and grants they can receive.** Aside from knowledge, the largest barrier to organics recycling cited was monetary cost. Therefore, Ramsey County Public Health should aim to inform the stakeholders of the monetary benefits of food/organics recycling; For example, stakeholders could reduce the total amount of tax they pay for solid waste by recycling more (no tax) and landfilling less (9.75% State Solid Waste Management Tax for Ramsey County). Additionally, many businesses may be interested to learn more about grants offered through BizRecycling and drop-off organics recycling services available in Ramsey County. Only 37.5% of all survey respondents knew about BizRecycling, and only one respondent (a school district) actually used BizRecycling. Therefore, Ramsey County Public Health should educate their local grocery stores and K-12 school districts about BizRecycling and the possible financial benefits to using BizRecycling.
- 5. Give local grocery stores guidelines for food waste reduction.** Although knowledge was not cited as one of the top barriers to food waste reduction by either of the stakeholder groups, the researchers felt it necessary to point out cited barriers that may benefit from education. Ramsey

County Public Health should educate grocery stores on simple techniques that help manage some of the top barriers for grocery stores: sales fluctuations, forecasting errors, and expiration date labels. Local grocery stores may also benefit from education on techniques to increase shelf-life of produce and prepared food and methods to train employees on best practices to reduce food waste, as packing/packaging and staffing challenges were also cited as larger barriers to food waste reduction. Of note, each grocery store may have its own unique challenges to food waste reduction.

What Ramsey County Public Health Should Encourage:

- 1. Use of methods that facilitate food waste/food donation management, such as consulting services or software/apps, especially within local grocery stores.** First, as many grocery stores indicated that sales fluctuations, forecasting errors, and expiration date labels are top barriers to food waste reduction, the researchers believe that it would be of benefit to Ramsey County Public Health to encourage their local grocery stores to use food waste management software/apps (see Section IV: Strategy 9, one example of this type of software is Eruza, an order management software for perishable food: <https://eruza.com/>). More research should be done on what software/apps are available and appropriate. Additionally, food donation software/apps (see Section IV: Strategy 8) may be of benefit to those that would like to donate food but may not have the time and/or knowledge to keep track of what food is good to donate and what would be better composted. As technologies continue to be developed, or if a related open-source platform solution is developed, the exploration of these new technologies by businesses could also be encouraged by the county.
- 2. Use of “ugly” produce and marketing “ugly” produce in an appealing way.** Only 41.7% of grocery stores sell ugly produce and 50% of grocery stores use “ugly” produce in their premade dishes, and only 33.3% of school districts used “ugly” produce in their dishes. The shortage of institutions that sell “ugly” produce is mostly likely due to the fact that they are more difficult to sell, as actually cited by some of our stakeholders; therefore, we recommend Ramsey County Public Health encourages the use of methods to market ugly produce in a more appealing way. For example, Ramsey County Public Health could design a marketing logo or slogan on a window sticker that advertises that the store uses/sells ugly produce and/or communicates that ugly produce still tastes good and is nutritious. Stores could display this sticker or logo in their store window or near their ugly produce. Ramsey County Public Health could also educate stakeholders methods that other institutions, such as Second Harvest Heartland (see Section IV), have used to educate others about “ugly” produce. For more ideas of where to find examples, the article by the

NRDC (2017), *Report Wasted: How America is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill*, also has a section outlining the movement of marketing “ugly” produce.

3. **School districts to educate their students about the implications of food waste and encourage their students to eat a full lunch.** One of our most surprising findings was that while the main barrier to food waste reduction in schools was children not eating all of their food, only two out of the six K-12 school districts cited that they make their students aware of the implications of food waste and actively encourage their students to eat their whole lunch. Ramsey County Public Health should encourage implementing this. Ramsey County school districts may benefit by following food waste reduction programs that have been used in other communities such as Eco-Cycle’s Green Star Schools Program, the Boulder/Broomfield County School Recycling and Environmental Education Program, and the Oakland Unified School District Green Gloves Program (see Section IV: Strategy 1). Ramsey County Public Health should also encourage school districts to get students involved in quantifying food waste. This can help make students and schools more aware about how food waste there is. Students in these groups could also serve as activists and encourage their peers to do an even better job at sorting their waste.
4. **Measurement of food wasted and donated.** For both local grocery stores and K- 12 school districts, there was wide variability in the accuracy of their reported estimates of the amount of food composted, food donated for human consumption, and food donated for animal consumption. Ramsey County Public Health should encourage local grocery stores, and especially school districts, to actively measure food donation and food waste. When institutions track their progress over time with fairly accurate measurements, they can see more easily which practices are or are not effective at reducing food waste. To encourage this practice, Ramsey County Public Health should consider grants or other financial incentives to institutions that are beginning or improving food waste/donation measurement. One stipulation of a grant/financial incentive could be that the data is reported to the county, which would benefit Ramsey County Public Health. Additionally, Ramsey County Public Health could encourage schools to involve students in this measurement tracking; this could be through clubs or in classes. Involved students could serve as activists within their school to use better food waste management practices. This may also be beneficial to students as they exercise their math and problem-solving skills on a real problem.

Survey Limitations

There are a few limitations to the present survey that the researchers would like to put forth. First, there is likely a sampling bias for local grocery stores, which has consequences for the generalizability of survey results. As can be seen in Table 1 above, out of 92 local grocery stores, the researchers were successfully able to make contact with only 47.8% (combines “declined” and “given survey” columns) of the local grocery stores, only 28.2% of local grocery stores were willing to participate, and only 13.0% of local grocery stores actually filled out the survey. Those who took the survey more than likely had a larger interest in reducing food waste within their institution than those who did not take the survey, whether it be for economic, environmental, or other gains; for instance, 91.7% of grocery stores indicated that they have an expressed commitment towards reducing food waste. Therefore, conclusions on both the degree of food donation/waste reduction and attitudes toward food donation/waste reduction are likely lower in the entire population of local grocery stores in Ramsey County than the results obtained from the survey.

Second, we were only able to obtain information on a subset of Ramsey County stakeholders. One major concern is that we only surveyed a subset of all grocery stores because we only obtained contact information for local, non-chain stores. Our sample did not include grocery stores such as Target, Cub, or Lund’s and Byerly’s. Along a similar line, we did not survey any educational institutions that serve students above the high school level. Another major concern is that while the institutions that we assessed have good potential to have rescuable food that can be diverted for human consumption, these institutions only count for a fraction of the food waste that typically occurs in various municipalities, with residents, farms, and restaurants/catering typically having the highest amount of food waste (NRDC, 2017a).

Third, while we technically obtain results for the entire population of public Ramsey County K-12 school districts, there may be aggregation issues. While we receive survey responses for the entire school district, it may be the case that there is variation amongst schools within a particular district. The survey respondent may have indicated a response that represents the majority of schools in the school district. For example, many schools in the district may have trade tables, but not all may. This is not captured in our survey data. It may also be the case that the respondent is not familiar with all schools in the district and is responding for only a subset of those schools with which they are familiar. This is not knowable from our survey data.

Finally, it is also important to note that public K-12 school districts are not the only school options in Ramsey County, private or charter schools also exist. Survey data for this population was not collected and therefore our analyses cannot represent the entire population of K-12 schools in Ramsey County.

Future Work: If Ramsey County would like to continue to target food waste to be *diverted for human consumption*, we recommend pursuing understanding of the other stakeholders that have great potential for rescuable food such as hospitals, other institutional food service (universities, hotels, etc.), chain grocery stores (e.g. Target, Lund's and Byerly's, etc.), and remaining educational institutions (private/charter K-12 schools & higher education institutions) and the barriers they face to food donation. If Ramsey County would like to target *general food waste reduction* in the future, rather than food waste to be diverted for human consumption, we recommend gaining information on food waste and barriers to food waste reduction for residents/consumers, farms, and restaurants/catering. Future studies are encouraged to draw from our findings and survey questions (see Appendix E).

Section V: Open-Source Technology

Introduction

The purpose of this section is to provide an introduction to Open-Source Technology, propose how it can be used to manage food supply chain operations and assist non-profit organizations, proposed future directions, and recommendations on how to support said network. Through open source technologies, users from different backgrounds can collaborate to develop applications that could not be created without an open dialect. By providing open and free technologies, stakeholders can create frameworks that meet their needs, but may be technically difficult to develop in a cost-effective manner and allow for fellow community members to bring those ideas to light. In addition, an open platform can also provide tinkers within the same communities an avenue to propose and build their own ideas with a benefit for the whole in mind.

Open-Source Software

Open-source software is software whose source code is available for users to modify within respect of the license of the original documentation (What is Open Source?). Through this system users can study, change, and distribute the software to anyone for any purpose that can be developed in a collaborative manner. According to a 2008 Standish Group report, open source software has the potential to save consumers \$60 billion in paid software savings (Free Open Source Software).

The Open Source Way

Open exchange, participation, rapid prototyping, meritocracy, and community. This idealistic view of open-source software was developed by Opensource.com and supported by Red Hat, an open-source software company recently acquired by IBM (What is Open Source?) Their vision allows for exchanges of free flowing ideas allowing users to learn about and further ideas, participate in an open and collaborative manner finding solutions to complex problems, rapid prototyping that creates an environment of building, failing, and repeating in order to produce an optimized products, meritocracy that allows the best and most useful ideas to thrive, and community to bring those with similar passions, but diverse backgrounds, into one arena to work together (What is Open Source?)

Open-Source & Food Security

Taking advantage of the eclectic population that makes up Ramsey County and Minnesota as a whole, a platform that takes the open source way at heart can be deployed to create a network of open innovation designed to develop efficient food systems, and more.

By creating a universal meeting point for consumers, retailers, distributors, growers, and other stakeholders, an open source technology has the potential to create solutions to long-standing problems within the food supply chain, in addition to identifying problems seen only by fringe parties.

Through the development of both a middleware and an operating system, the needs of the stakeholders can be met in the form of simple user generated applications found on mobile devices for routine use, or in the development of a ground-up operating system for use at the enterprise level. By creating a network of basic applications, middleware, and enterprise level software organizations operating as non-profits, small and medium businesses, and corporations alike can use predictive statistical analysis to reduce sunk costs in spoiled inventories, predict community demand, record daily business operations, and more under a common goal of community improvement.

Finally, through an open initiative, the sharing of repetitive data can be used to optimize these general systems for open use and long-term self-sufficiency.

Ternary Food Network

One person's waste is another's feast. The original purpose of this section was to develop a definition of what food waste is considered. Through literature research and interviews, the question of what food waste is presented itself as a subjective matter based on the mission and available resources to the stakeholder.

An example of this, through an informal interview demonstrated that a local restaurant would refrigerate or dispose of excess food after closing dependent on the amount of food leftover, amount of staff present that day, and available space in their refrigeration system.

Through education, as noted in following sections, better practices can be developed to optimize food recycling methods for stakeholders' internal operations, avoiding food waste creation exemplified by the above example.

In addition to education, the adoption of technology can assist in food waste reduction by creating unique data sets based on the recording of individual internal and external stakeholder activity.

For this report, a proposed Ternary Food Network can be used in similar fashion to Google and Facebook, using mathematical themes from graph theory to find and track relationships between stakeholders in food transactions creating a living definition of food waste.

Using an open-source graph database such as GraphDB or Neo4j as the mechanics consisting of nodes (stakeholder and their attributes) and edges (the relationship between the stakeholders) of this application, a ternary model can be designed to monitor the quality of food donations from stakeholder A to B. Similar to a street stop light, through a web or mobile application stakeholder A can classify the quality of food donated to stakeholder B as good (green), neutral (yellow), or bad (red) based on their organizational training and opinion. After the transaction is complete, stakeholder B rates the quality based on their capabilities and training in the same fashion of green, yellow, and red.

After multiple transactions, archived transactions can be used to determine the cost analysis for each organization in the relationship using basic data from the collection of green, yellow, and red transactions. Depending on the cost analysis, suggestions can be made for each node suggesting educational tools to better a relationship or other nodes that could promote a more efficient use of resources.

Advantages & Disadvantages:

Creating an open-source community requires initial organization and time in order to develop a mission that is sustainable in the long-term. In comparison, business such as Winnow solutions and Zero Percent provide paid for services that are designed to provide data analytics on logged food waste as well as provide networking and food distribution services respectively. These services have the advantage of having a single technology contributor that is generating revenue

and are capable of meeting technical needs based on a client-to-client basis that will not be seen immediately under an open source platform. In addition, with the control of the technology under one umbrella, these businesses can prevent malicious parties from adding unwanted source code.

An open source community can potentially surpass these types of organizations through fast adoption of the platform because of the ease of access, lack of charges on basic packages, creativity harnessed from the community, and technical skills found in the diversity of Ramsey County residents. In addition, debugging of software by an active community can bring technically sound products to the market faster. Finally, while malicious parties have direct access to source code, the same active community that is looking for source code errors also add a security barrier by removing malicious code from software packages (Verelst & Mannaert).

Future Directions & Recommendations:

In order to proceed with this concept, a community that represents all of the stakeholders needs to first be created. Through open dialect, the needs in enterprise and application-based software can be discussed and initial technological builds can be created. Next, community engagement needs to be fostered. Through interactions with “hacker” communities such as IoTFuse, relationships can be developed with technically savvy minds for discussions of collaboration. In addition, through the sponsoring of events such as hackathons, momentum can be created in the form of friendly competition and open knowledge sharing at talent rich environments such as Universities and Community Colleges. In addition to hackathons, conferences such as Open-Source North can create more avenues to discuss the mission of the platform with those who have experience in creating open-source projects. Finally, after a minimum viable product has been designed, partnerships with larger corporations such as IBM should be considered, as they have access to data storage, cloud computing, and open-source systems.

Our recommendation is to determine vital stakeholders and create a basic open dialogue probing for interests in an open-source platform originally designed to find solutions to current and potential food waste problems.

Conclusion

Open source technologies have the ability to transform the passion observed in staff from Second Harvest, NRDC, and other organizations under strenuous budgets, into open community driven

projects. These open source projects can make everyday gardeners into stakeholders by allowing less technically talented people to share their ideas to the public creating de-novo collaborations between parties that would usually not interact.

Supplementary Perspective Technology Modules

Open source GIS Help-Me: This middleware would create a short message service utilizing Ramsey County's current food diversion GIS system. With the public transportation service in mind, this system would create a platform allowing users to interact with a virtual help desk, giving them information on surrounding food services based on their location. A partner to consider for this is Kipsu, a Minneapolis based startup.

Section VI: Conclusion & Recommendations

Overall, Ramsey County is well-positioned to reduce food waste within its borders. One potential resource the county may use in working towards the reduction of food waste is open- source technology. This technology is a powerful tool that may be used in managing food supply chain operations for businesses and nonprofits. With the county in a facilitation role, relationship development between key stakeholders is within reach. In addition, the Ternary Model of food waste allows organizations to effectively communicate with one another regarding their food waste issues and needs. Furthermore, by helping the facilitation of long-term relationships between its local stakeholders that are built upon food waste diversion and reduction, Ramsey County may maximize sustained impact while minimizing their own effort.

The analyzed case studies demonstrate the possibility of success in targeting lower-power stakeholders such as individuals and small local businesses. The food waste stream involves stakeholders with power classified by this report as “low”, “medium” or “high”, and the best role for Ramsey County seems to be in targeting the lower-powered stakeholders. This is for a multitude of reasons, including the potential apathy on the part of high-power stakeholders.

Finally, based on analyzed survey results, the combination of policies the county should adopt can be summarized by an approach including the thematic areas “Provide”, “Educate” and “Encourage”. Generally, these policy areas involve the provision of resources to stakeholders, the disbursement of education on evolution in food waste policy and encouraging county residents to continually engage with these food waste and disbursement related issues in their daily lives. These policies are certainly not a fix-all, however, at the county level, based on the scope of this project, we believe that there are tangible steps that may be taken in order to redistribute food waste and alter the current model in a positive way.

Appendix A: Stakeholder Analysis Detail

What would happen if each stakeholder contributed more to reducing food waste, and how can they be engaged to do so?

Primary Objective: Analyze the stakeholders within Ramsey County and how more effective engagement of these groups or individuals may lead to equitable food justice-based outcomes.

Summary of top engagement suggestions for multiple key stakeholders:

1. Start (or join and augment) an “integrative leadership” coalition of key representatives from each primary stakeholder group, and hold monthly/quarterly meetings to discuss ways in which they can support and work together towards the common goal of diverting and reducing food waste.
 - a. Also connect via forums/emails to ask questions, make requests, create joint plants, etc., on behalf of other stakeholders in group.
 - b. Hold or host annual open forum/workshops for larger audience where key representatives in coalition present and lead discussions that builds energy and momentum for people/orgs to take action.
 - i. Examples: [EPA Food Recovery Summit info for stakeholders](#), [Zero Food Waste Forum in various cities](#), [WasteCap in Milwaukee](#)
2. Create “in group” in which stakeholders can become members to publicly demonstrate their commitment, keep up to date on goal status and connect with others:
 - a. “Proud member of Ramsey County Food Waste Reduction Program. To learn more about the positive impact we’re having on our county, go here: [website or QR Code]”
 - b. Include in public directory for both recognition and also as a resource for others orgs/individuals to contact them for advice and ideas.
 - c. Require quiz or continuing education to demonstrate baseline knowledge of the problem and its solutions.
3. Create or discover and build upon library of resource documents that are applicable to many stakeholders so they can be experts and inspired to share that expertise with others.
 - a. This would include articles, videos, educational campaign materials and other content that is easy to digest and share.
 - b. Push these items out to stakeholders through (noninvasive) mass communication
 - c. Could be combined with 1a above - have it be a dynamic space that stakeholders can edit and contribute to (similar to a Google Drive folder)

For Profit Businesses

Stakeholders

1. Grocery Stores ([Cub](#), [Whole Foods](#), [Aldi](#), [Co-ops](#), [STP Commerce Directory](#))
2. Grocery at diversified retail ([Target](#), [Walmart](#))
3. Restaurants - non-chain/local (St. Paul Grill, Urban Growler, Pazzaluna, [STP Commerce Directory](#))
4. Restaurants - chain/national ([McDonalds](#), [Caribou](#), [Chipotle](#))
5. Farms/Producers (incl. [Farmer's markets](#) & association branches like [MN Farmers Union](#))
6. [Food trucks](#) & [Caterers](#) (incl. Brick & mortar subsidiaries like [El Burrito Mercado](#) and [Kincaid's](#))
7. Food Manufacturers (General Mills, Summit Foods, Old Dutch)
8. Food mass transportation services ([C.H. Robinson](#), [Murphy Warehouse](#), [Trademark Transport](#))
9. Food small scale transportation/delivery (Grubhub, Bitesquad, UberEats)
10. Farm suppliers/support (e.g. seed, equipment, fertilizer, flash freezers - [CHS](#), [Winfield United](#))
11. Hotels and other lodging ([STP Commerce Directory](#))
12. Major non-food corporations ([Ecolab](#)), incl large nonprofits ([MPR](#))
13. Major office buildings and leasing companies (e.g. [CSM](#), [Colliers Intl](#), [CBRE](#))
14. Small local non-food businesses (Neighborhood Associations like [Grand Ave Biz Assoc](#))

Engagement Ideas/Resources

1. Create [informational documents/pamphlets like this](#) from Hennepin County
 - a. [NRDC website library](#) has many educational materials as well
2. Inform/Educate the public: <https://www.youtube.com/watch?v=g3VtpgzNMIE> and lots of other videos online - might be worth compiling them in one list that stakeholders can access
 - a. And share information about how it benefits them (and their bottom line) ([example](#)). And [guides to measure waste](#).
3. Helpful apps/programs to reduce/divert waste: [Meal Connect](#), [SimpleOrder](#), [IBM Food Trust](#), [Spoiler Alert](#), [Food Cowboy](#), [Food Rescue Us](#), [Copia](#)
4. Create in group w/ membership: "Proud member of Ramsey County Food Waste Reduction Program. To learn more about the positive impact we're having on our county, go here: [website or QR Code]"
 - a. [Decal example](#)
 - b. [Certificate example](#)
 - c. [Online listing example](#)
5. Reducing food waste could help with membership to pledge [1% group](#) or [B Lab](#)

6. Host or hold a forum on food waste to connect and motivate diverse stakeholders, like [Zero Food Waste Forum in various cities](#) or [WasteCap in Milwaukee](#)

Public Orgs & Nonprofits

Stakeholders

1. Nonprofits focused on food diversion/deficits ([Secondhand Harvest](#), [Loaves & Fishes](#), [TC Food Justice](#), [The Food Group](#), some other good examples listed here: https://www.ramseycounty.us/sites/default/files/Government/Leadership/Advisory%20Groups/Food%20and%20Nutrition%20Commission/FNC_food_access_organizations_in_ramsey_county.pdf)
2. Ramsey County - esp. Waste Mgmt & Public Health-Environmental Health Divisions
3. Schools: K-12 (incl. Student orgs, class assignments, research. [School districts](#))
4. Schools: College (incl. Student orgs, class assignments, research. e.g. [schools in St. Paul](#))
5. Hospitals that serve food ([Regions](#), [United](#), [St. Joseph](#), [STP Commerce Directory](#))
6. [City/Municipal govts](#) within Ramsey County
7. Other counties, esp. neighboring (Hennepin)
8. State of Minnesota
9. Small nonprofits not focused on food diversion/deficits
10. Museums (e.g. [Science](#), [Children's](#))

Engagement Ideas/Resources

1. Create [informational documents/pamphlets like this](#) from Hennepin County
2. Inform/Educate the public: lots of videos ([example](#)) and documents online (including in our shared Google Drive folder) - might be worth compiling them in one list or library to share with stakeholders
 - a. Encourage educational advertising from national food diversion nonprofits/orgs and use their resources ([Save the Food Campaign example](#) that Joane mentioned, [Love Food Hate Waste](#) from UK, [Love Food No Waste](#) from OR)
 - b. School educational engagement video [example](#) (made by Ramsey County) and [another](#) from Seattle where [recycling/composting is law](#). Help schools [measure food waste](#).
3. Encourage presence of new programs: [Rescuing Leftover Cuisine](#),
4. Create in group w/ membership: "Proud member of Ramsey County Food Waste Reduction Program. To learn more about the positive impact we're having on our county, go here: [website or QR Code]"
5. Ramsey County to become member in nonprofit programs/associations like [100 Resilient Communities](#)

6. Empower companies to hold own presentations with premade slides ([EPA example](#), [LeanPath example](#))

Large spaces

Stakeholders

1. [MN State fairgrounds](#)
2. [Xcel energy center](#)
3. [RiverCentre](#)
4. [CHS Field](#)
5. [Allianz Field \(Soccer\)](#)
6. Malls ([Maplewood](#), [Rosedale](#))
7. [Outdoor parks/rec areas managed by cities/county](#)
8. [State capitol](#) and other [historical sites](#)
9. [Smaller indoor event spaces](#) (e.g. venues for weddings, corporate events, country clubs)
10. Theaters w/ food/drink ([Movies](#), [Palace](#), [Fitzgerald](#) - bought by First Ave??)
11. More various examples: [STP Commerce Directory](#), [Ramsey County Directory](#)

Engagement Ideas/Resources

1. Create [informational documents/pamphlets like this](#) from Hennepin County
2. Inform/Educate the public: lots of videos ([example](#)) and documents online (including in our shared Google Drive folder) - might be worth compiling them in one list or library to share with stakeholders
 - a. Encourage educational advertising from national food diversion nonprofits/orgs and use their resources ([Save the Food Campaign example](#) that Joane mentioned, [Love Food Hate Waste](#) from UK, [Love Food No Waste](#) from OR)
 - b. Encourage free/discounted advertising to educate public about food diversion
 - c. [Share guides](#) or develop our own to help venues learn best practices
3. Encourage presence of new programs: [Rescuing Leftover Cuisine](#),
4. Create in group w/ membership: “Proud member of Ramsey County Food Waste Reduction Program. To learn more about the positive impact we’re having on our county, go here: [website or QR Code]” **Individuals/Households**

Stakeholders

1. People receiving more food/access
2. Homeowners
3. Public housing & Renters
4. Students (K-College)
5. People employed by aforementioned stakeholders

6. Visitors/Tourists
7. Investors

Engagement Ideas/Resources

1. Create [informational documents/pamphlets like this](#) from Hennepin County
2. Inform/Educate the public: lots of videos ([example](#)) and documents online (including in our shared Google Drive folder) - might be worth compiling them in one list or library to share with stakeholders
 - a. Encourage educational advertising from national food diversion nonprofits/orgs and use their resources ([Save the Food Campaign example](#) that Joane mentioned, [Love Food Hate Waste](#) from UK, [Love Food No Waste](#) from OR)
 - b. Provide resources/materials to help them develop their own local neighborhood/organization club
3. Connect with apps/tools to measure and reduce waste: [EPA tools](#) (tons of content throughout their website), [EatSmartWasteLess](#)
4. Create in group w/ membership: “Proud member of Ramsey County Food Waste Reduction Program. To learn more about the positive impact I’m having on our county, go here: [website or QR Code]”

Nature/Environment

Stakeholders

1. Animals - Feed
2. Animals - Other
3. Plants - Crops
4. Plants - Other
5. Climate
6. Farmland

Engagement Ideas/Resources

1. Create [informational documents/pamphlets like this](#) from Hennepin County

Appendix B: Gaps Analysis Figures

Table B-1. Description of different sources of revenue, expenditures, and organics recycling methods for Ramsey County as compared to Hennepin County and Washington County. Bolded values represent notable differences emphasized in the text.

Description		Ramsey County	Hennepin County	Washington County
Revenues	Service Fees	\$11,606,554	\$3,805,263	\$3,071,940
	Processing Facility Tip Fees	\$330,993	\$0	\$0
Expenditures	Planning and Administration	\$3,301,104	\$2,085,439	\$338,174
	Recycling	\$2,614,650	\$1,567,008	\$0
	Organics	\$950,286	\$689,525	\$113,205
	Source Reduction	\$0	\$33,500	\$0
	Waste-to-Energy Processing	\$3,021,470	\$0	N/A
Organics Collected for Recycling (tons)	Food-to-Livestock	41,623	24,308	15,536
	Food-to-People	2,663	0	835

Table B-2: Existing Food Rescue Organizations in Twin Cities

Organization	Description	Website
Second Harvest Heartland	Food bank; collects, stores, and distributes food that may go to waste; covers a large area over MN and western WI	https://www.2harvest.org/
Twin Cities Food Justice	Provides food pick up from retailers and delivery service to hunger relief organizations; Minneapolis-based nonprofit	https://www.tcfoodjustice.org/
North Country Food Alliance	Rescues and distributes food with goal of reducing waste and increasing access; focus on fresh produce from grocery stores and coops; nonprofit	https://northcountryfoodalliance.org/
Sisters Camelot	Obtain food close to expiration date from warehouses and redistribute in Twin Cities food deserts from bus; maintain a permaculture garden; nonprofit	https://sisterscamelot.org/
Loaves and Fishes	Free meal program; has a food rescue program and obtains food by other means also; MN-based nonprofit	http://www.loavesandfishesmn.org/index.html
The Food Group MN	(formerly the Emergency Foodshelf Network) Accepts food donations; partners with food shelves and meal programs to distribute food	https://thefoodgroupmn.org/

Table B-3: Food waste gaps, strategies, and local partnership opportunities.

Ramsey County Food Waste Gaps	Strategy	Examples of Implementation	Local Partnership Opportunities
<p>Lack of focus on waste reduction. Food waste reduction and food rescue focuses on large sources of food waste. This neglects consumers, who are responsible for the greatest amount of food waste (43%).</p>	<p>Consumer Education Campaigns</p>	<p>Boulder/Broomfield County School Recycling and Environmental Education Program</p>	<p>Ramsey County Public Schools may be encouraged to introduce an environmental stewardship component to their educational programs. This may include having children track food waste in their homes, teaching them (and their parents) how best to reduce food waste.</p>
		<p>Oakland Unified School District Green Gloves Program</p>	<p>MN GreenCorps (Government program coordinated by MN Pollution Control Agency and AmeriCorps) places AmeriCorps members on projects addressing MN-specific environmental needs. They recently completed a number of projects relating to food waste, including educational initiatives in schools, <i>e.g.</i> one 2018-2019 project involved implementing a food waste reduction and recycling program in four St. Cloud Area School District elementary schools</p>
		<p>FeedBack</p>	<p>Eureka Recycling (Recycling service operating in Ramsey County) provides zero-waste training and programs such as "make dirt not waste" educational resources and events on composting <i>Example:</i> Provided educational materials for consumers as part of Dakota County's campaign to reduce food waste</p>
			<p>Twist-Ease may increase produce longevity and weight measurement accuracy, and the company may want to create informational materials for grocery stores. A partnership with the county in these endeavors (allowing the county to add in more educational materials) could be mutually beneficial (helping marketing strategy for Twist-Ease, and provide educational funding for the county).</p>

			<p>Save The Food is a food waste reduction ad campaign created by NRDC and the Ad Council. Publishes reports on causes and scope of food waste, and info about promising solutions. Recently implemented in Twin Cities to raise food waste awareness</p>
	Gardner Engagement	<p>Urban Harvesting Program</p> <p>Homegrown Minneapolis/Garden Lease Program</p>	<p>Local grocery retailers may be encouraged to accept produce donations from local gardeners by allowing them to count the weight of donations toward their enhanced tax credits. These donations would then be picked up by Second Harvest Heartland (large retailer, 3-5x weekly pickups) or MealConnect Drivers (smaller grocers, as need arises).</p>
<p>AmpleHarvest.org connects gardeners with local food shelves to enable fresh produce donation and reduce food waste from gardens.</p>			
<p>The Good Acre is a “Food Hub” in Falcon Heights with produce storage and processing facilities that are available for rent. These facilities could be utilized to increase processing, transport, and consumption of produce from local gardens. They also cooking classes, recipes, farmers markets, and grower support.</p>			
<p>Food waste going to landfill instead of recycling. Food waste is diverted to landfills from a variety of sources:</p>	Food to Livestock	KDC Agribusiness	<p>Saint Paul Public Schools previously operated a food-to-hogs program. Expansion of the food-to-hogs program to include non-profits would increase the distribution of food waste to higher in the food waste hierarchy.</p>
			<p>BizRecycling provides consulting services and funding opportunities to help organizations start a food-to-hogs program</p>

<p>Nonprofits: Bakery items represent an unwanted excess of food donations for non-profits involved in food rescue. They cannot be used in an anaerobic digester, and are composted.</p> <p>Individuals: Often lack convenient opportunities or incentive to recycle food waste.</p> <p>Businesses: Often lack incentive to sort and recycle organic waste.</p>	Food Waste Dropoff Sites	<p>Western Lake Superior Sanitary District (Duluth, MN)</p> <p>Tompkins County, NY</p> <p>Love Food Not Waste (Eugene, OR)</p>	<p>Vivid Life Sciences is a Minneapolis-based ag startup making crop protection and fertilizer products; LifeForce fertilizer is made from grocery store food waste</p>
			<p>The Mulch Store: Professional landscaping companies such as The Mulch Store accept organic waste which they use to produce compost</p>
	Recycling Contract Negotiation for Businesses	<p>Cupertino, CA</p> <p>Love Food Not Waste (Eugene, OR)</p>	<p>Recycling Service Providers in Ramsey County can offer discounts and recycling training to businesses</p> <p>BizRecycling can help businesses set up new recycling programs and connect them with the most affordable recycling service providers</p> <p>MN WasteWise provides waste sorting/waste stream analysis services that can help determine prevalence of different types of food waste</p>
Expanded Organics Recycling Services	<p>Portland, OR</p> <p>Austin TX</p> <p>San Francisco, CA</p>		

	Anaerobic Digestion	<p>West Lafayette, IN</p> <p>Hennepin County, MN (in progress)</p>	<p>Hennepin County is currently seeking partnerships to set up an anaerobic digestion facility in order to reduce landfill waste. Requested plans/proposals from vendors to demonstrate that they could process a minimum of 25000 tons of organic waste per year. There may be opportunity for Ramsey County to learn from Hennepin county's experience with this process and connections with potential vendors.</p>
<p>Food waste from small businesses. Food waste reduction and food rescue focuses on large sources of food waste. This neglects small businesses.</p>	Donation Matching Software	Food Rescue US	<p>MealConnect (SHH) MealConnect connects caterers with nearby food shelves. If this was expanded to include produce from small businesses and corner stores, this would encourage food rescue through the reduction of waste fees for small businesses.</p> <p>Zero Percent is a tech startup with; app and delivery service to help restaurants and grocers coordinate with local food shelves; expanded to Twin Cities in 2016</p> <p>Spoiler Alert is a software that interfaces with a retailer's inventory management program and sends out blast notifications to nearby food shelves when food donations are available for pickup.</p> <p>Copia is an app that can be used as a delivery service to help restaurants, grocery retailers, caterers, etc. deliver their excess food to nearby food shelves.</p> <p>MN Food Waste Forum is an online forum aimed at reducing food waste and hunger; intended to be a web resource for different groups working with the food supply chain to connect and work together</p> <p>Online Marketplace (Feeding America) is an online tool to help food service businesses coordinate donations with local food banks</p>

			Food Cowboy has hotline for potential food donors to call to coordinate donation and transportation to local food banks or nonprofits
	Consulting services and software to help small businesses analyze, reduce, and manage food waste	Food Waste Experts	MN Waste Wise Foundation provides sustainability/recycling consulting services. <i>Example:</i> Previously partnered with Silhouette Bakery and Bistro in St. Paul to create a food waste recycling plan and obtain \$4600 in grant funding from BizRecycling for recycling supplies and compostable materials
			BizRecycling provides consulting services and funding opportunities to help businesses start up or improve existing recycling programs
			Winnow Solutions provides technology to help commercial kitchens track and reduce food waste

Appendix C: Ramsey County Food Distribution Pipeline

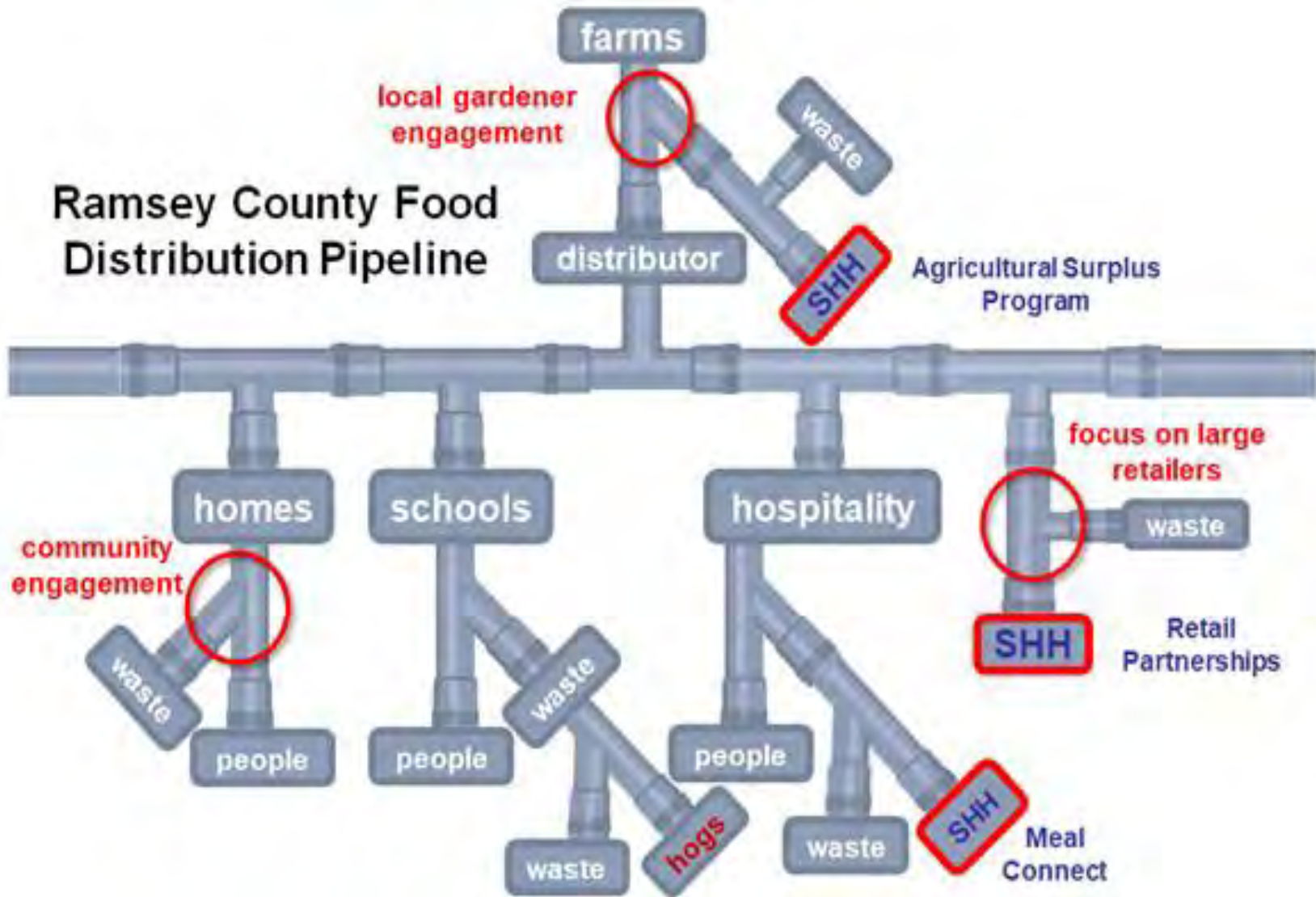


Figure C-1: Ramsey County specific Food Distribution Pipeline. Food starts at farms, where it can be sent to distributors (either grocery retailers, or the companies that retailers purchase produce from). Food may be purchased from distributors by people, schools, or as part of the hospitality industry (in this report, the hospitality industry groups together institutions wherein a large amount of prepared food is distributed for human consumption). Each branch in this simplified pipeline includes waste. Low yields (product eaten vs. product thrown away) across multiple steps causes a large cumulative total of food sent to landfill and represents a significant percentage of food produced at the farm. Present food waste reduction (food-to-hogs, or “hogs”) and food redistribution efforts (SHH) in RC are also detailed. Highlighted in red are significant gaps discussed in this report.

Appendix D: Survey Case Study Summaries

Case Study #1:

Institution Name: Maryland Super USA

Institution Type: Local Grocery Store

Number of Employees: 2

Food Waste Summary: Institution indicated that food products that are out of date, close to expiration, and have damaged packaging are all thrown out. Major causes of unsaleable food noted were expiration, food that is almost out of date, and lack of customers purchasing “ugly” produce. They also noted that “the required [*sic*] from the county to have Ebt or wic” was the factor that contributed most to the quantity of unsaleable food at their institution. They do not compost their food waste.

Food Donation Summary: Institution indicated that they do *not* donate to food banks. They reported that they donated approximately 30 pounds (or \$400) monthly for *animal* consumption and reported the highest level of accuracy (i.e., “based on actual recorded measures”) at assessing the amount of food donated toward animal consumption monthly.

Food Waste Reduction Barriers Cited: Stock management, forecasting errors, sales fluctuations, and packing/packaging were cited as extreme barriers to food waste reduction; displays and promotional products were cited as common barriers to food waste reduction.

Food Donation Barriers Cited: Insufficient refrigeration and/or storage at food bank was cited as an extreme barrier to food donation; knowledge about best ways to donate unsaleable food was cited as a common barrier to food donation.

Food Composting Barriers Cited: Institution did not list any common or extreme barriers to composting.

Food Donation and Waste Reduction Attitudes: Institution indicated that reduction of food waste is very important to them and that they have an expressed commitment to reducing food waste. They do not sell ugly produce (i.e. produce with blemishes) or use ugly produce in their pre-made dishes. They do sell items that are close to expiration at a reduced rate. They did not

indicate that any of the incentives provided in the survey would incentivize their institution to divert more unsaleable food toward donation than it currently does.

Case Study #2:

Institution Name: Mississippi Market (7th Street)

Institution Type: Local Grocery Store

Number of Employees: 3

Food Waste Summary: Indicated that food products that are out of date are either donated or composted; food products that are close to expiration are donated, used/sold, or composted; food products that have damaged packaging are either donated or used/sold. The major cause of unsaleable food noted was expiration. They also noted explicitly that “expired food” was the factor that contributed most to the quantity of unsaleable food at their institution. They reported that they compost approximately 10,000 pounds of food monthly but reported the lowest level of accuracy (i.e., “best guess based on experience”) at assessing the amount of food composted monthly.

Food Donation Summary: Institution indicated that they donate food to Hallie Q Brown food shelf, which is located in St. Paul. They reported that 61% of their food donations within the past year were processed foods, 20% were vegetables, 20% were fruits, 11% were meats, 30% were dairy products, and 51% were whole-grain products; as the percentages of reported donation in each category do not add up to 100%, we are unsure of the accuracy of each of these estimates. They reported that they donated approximately 1,000 pounds monthly but reported the lowest level of accuracy (i.e., “best guess based on experience”) at assessing this amount. They reported that they donated for animal consumption approximately 3,000 pounds monthly but, again, reported the lowest level of accuracy (i.e., “best guess based on experience”) at assessing the amount of food donated toward animal consumption monthly.

Food Waste Reduction Barriers Cited: Overproduction of prepared food was cited as a common barrier to food waste reduction. The institution did not cite any other common or extreme barriers to food waste reduction.

Food Donation Barriers Cited: Institution did not list any common or extreme barriers to food donation.

Food Composting Barriers Cited: Institution did not list any common or extreme barriers to composting.

Food Donation and Waste Reduction Attitudes: Institution indicated that reduction of food waste is extremely important to them and that they have an expressed commitment to reducing food waste. While they do not sell ugly produce (i.e. produce with blemishes), they do use ugly produce in their pre-made dishes. Additionally, they sell items that are close to expiration at a reduced rate. They did not indicate that any of the incentives provided in the survey would incentivize their institution to divert more unsaleable food toward donation than it currently does.

Case Study #3:

Institution Name: Minnehaha Grocery

Institution Type: Local Grocery Store

Number of Employees: (Indicated “0”)

Food Waste Summary: Indicated that food products that are out of date are either donated or taken home; food products that are close to expiration put on sale and then donated if gone past the expiration date; food products that have damaged packaging are returned to the wholesaler. There were no major causes of unsaleable food noted, but they did note past season food/left over after holiday as a moderate cause of unsaleable food. They also mentioned that they believe “the environment inside” contributes the most to the quantity of unsaleable food at their institution; more details about this were not given. They reported that they compost approximately \$50 of food monthly and reported moderate accuracy (i.e., in between “best guess based on experience” and “based on actual recorded measures”) at assessing the amount of food composted monthly.

Food Donation Summary: Institution indicated that they do *not* donate to food banks. They reported that they donated approximately \$20 of food monthly for *animal* consumption and reported moderate accuracy (i.e., in between “best guess based on experience” and “based on

actual recorded measures”) at assessing the amount of food donated toward animal consumption monthly.

Food Waste Reduction Barriers Cited: Expiration date labels was cited as an extreme barrier to food waste reduction; displays and promotional products were cited as common barriers to food waste reduction.

Food Donation Barriers Cited: Legal liability concerns and knowledge about best ways to donate unsaleable food were cited as extreme barriers to food donation; time constraints and transportation constraints (e.g., distance, fleet, etc.) were cited as common barriers to food donation.

Food Composting Barriers Cited: Institution did not list any common or extreme barriers to composting.

Food Donation and Waste Reduction Attitudes: Institution indicated that reduction of food waste is extremely important to them and that they have an expressed commitment to reducing food waste. They do not sell ugly produce (i.e. produce with blemishes) or use ugly produce in their pre-made dishes. They do sell items that are close to expiration at a reduced rate. They did not indicate that any of the incentives provided in the survey would incentivize their institution to divert more unsaleable food toward donation than it currently does.

Case Study #4:

Institution Name: St. Paul Farmers’ Market

Institution Type: Local Grocery Store

Number of Employees: 20

Food Waste Summary: Indicated that food products that are out of date or close to expiration are either donated, used and/or sold, composted, or fed to animals; food products that have damaged packaging are non-applicable, as food has no packaging. Major causes of unsaleable food noted were expiration and “fresh produce, good til [*sic*] it starts to go bad”. Moderate causes of unsaleable food noted were food that is almost out of date and lack of customers purchasing “ugly” produce. They also noted that “produce past its prime” was the factor that

contributed most to the quantity of unsaleable food at their institution. They reported that they compost approximately 10,000 pounds of food monthly but reported the lowest level of accuracy (i.e., “best guess based on experience”) at assessing the amount of food composted monthly.

Food Donation Summary: Institution indicated that they donate food to Neighborhood House, which has two food markets in St. Paul. They reported that 81% of their food donations within the past year were vegetables and 19% were fruits. They reported that they donated approximately 8,000 pounds monthly and reported the highest level of accuracy (i.e., “based on actual recorded measures”) at assessing the amount of food donated monthly. They reported that they donated approximately 3,000 pounds monthly toward animal consumption but, reported the lowest level of accuracy (i.e., “best guess based on experience”) at assessing the amount of food donated toward animal consumption monthly.

Food Waste Reduction Barriers Cited: Sales fluctuations and “weather, growing season” were cited as extreme barriers to food waste reduction; forecasting errors and improper handling of food were cited as common barriers to food waste reduction.

Food Donation Barriers Cited: Transportation constraints was cited as an extreme barrier to food donation. Institution did not cite any common barriers to food donation.

Food Composting Barriers Cited: Institution did not list any common or extreme barriers to composting.

Food Donation and Waste Reduction Attitudes: Institution indicated that reduction of food waste is very important to them; however, they do not an expressed commitment to reducing food waste. They do sell ugly produce (i.e. produce with blemishes) and use ugly produce in their pre-made dishes. They do not sell items that are close to expiration at a reduced rate. They indicated that the following incentives would incentivize their institution to divert more unsaleable food toward donation than it currently does: publicity with the market or community, strengthening of employee engagement/culture, strengthening of relationships with local businesses/nonprofits, and increased differentiation (i.e., making your business stand out against others).

Case Study #5:

Institution Name: Hampden Park Co-Op

Institution Type: Local Grocery Store

Number of Employees: 30

Food Waste Summary: Indicated that food products that are out of date are used/sold or used by staff; food products that are close to expiration are donated; food products that have damaged packaging are submitted back to the vendor for credit. There were no major causes of unsaleable food noted, but they did note that food that is almost out of date and past season food/left over after holiday as moderate causes of unsaleable food. They also noted that “un purchased [sic] produce” was the factor that contributed most to the quantity of unsaleable food at their institution. They reported that they compost approximately 500 pounds of food monthly and reported moderate accuracy (i.e., in between “best guess based on experience” and “based on actual recorded measures”) in their estimate.

Food Donation Summary: Institution indicated that they donate food to Keystone Community Services, which operates several food shelves in Ramsey County. They reported that 20% of their food donations within the past year processed foods, 50% were vegetables, 30% were fruits, and 20% were whole grains; the percentages of reported donation in each category do not add up to 100%, therefore we are unsure of the accuracy of each of these estimates, however, we believe the respondent may have lumped in “whole grains” with “processed foods”. They reported that they donated approximately 220 pounds monthly and reported the second highest level of accuracy (i.e., one step below “based on actual recorded measures”) at assessing the amount of food donated monthly. They reported that they do *not* donate any food for animal consumption.

Food Waste Reduction Barriers Cited: Sales fluctuations, staffing challenges, and insufficient refrigeration and/or storage on site were cited as extreme barriers to food waste reduction; overproduction of prepared food was cited as a common barrier to food waste reduction.

Food Donation Barriers Cited: Improper refrigeration and/or storage on site and improper refrigeration and/or storage at the food bank were cited as extreme barriers to food donation. Institution did not cite any common barriers to food donation.

Food Composting Barriers Cited: Institution did not list any common or extreme barriers to composting. All barriers to composting/recycling food and organics listed in survey question were marked as ‘not at all a barrier’.

Food Donation and Waste Reduction Attitudes: Institution indicated that reduction of food waste is extremely important to them and that they have an expressed commitment to reducing food waste. They do sell ugly produce (i.e. produce with blemishes) and use ugly produce in their pre-made dishes. They also sell items that are close to expiration at a reduced rate. They indicated that the following incentives would incentivize their institution to divert more unsaleable food toward donation than it currently does: tax incentives, publicity with the market or community, strengthening of employee engagement/culture, reduction of the cost of discarding food waste, strengthening of relationships with local businesses/nonprofits, increased differentiation (i.e., making your business stand out against others), and strengthening the likelihood that people will reciprocate when they can afford it (i.e., people your business donated to may buy more from your business in the future).

Case Study #6

Institution Name: Forest Lake ISD 831 (*Note:* this is a Washington County ISD)

Institution Type: K-12 School District

Number of (Food Service) Employees: 70

Food Waste Summary: Institution indicated that food products that are out of date are thrown away; food products that are close to expiration are attempted to be used before they expire; food products that have damaged packaging are returned to the distributor. There were no major or moderate causes of unsaleable food noted; however, they noted that “equipment not working” was the factor that contributed most to the quantity of unsaleable food at their institution, but no more detail was provided. They do not compost their food waste.

Food Donation Summary: Institution indicated that they do *not* donate to food banks. They reported that they donated approximately 5,250 pounds monthly for *animal* consumption but reported the lowest level of accuracy (i.e., “best guess based on experience”) for this estimate.

Food Waste Reduction Barriers Cited: Institution did not list any common or extreme barriers to food waste reduction.

Food Donation Barriers Cited: Time constraints and insufficient refrigeration and/or storage at food bank were cited as extreme barriers to food donation; transportation constraints (i.e., distance, fleet, etc.) was cited as a common barrier to food donation.

Food Composting Barriers Cited: Time constraints was cited as an extreme barrier to composting food/organics; knowledge about the best way to recycle food waste/organics, transportation constraints (e.g., distance, fleet, etc.), and monetary cost of recycling organics were cited as a common barriers to composting food/organics.

Food Donation and Waste Reduction Attitudes: Institution indicated that reduction of food waste is very important to them; however, they do not have an expressed commitment to reducing food waste. They indicated that they do use ugly produce in their pre-made dishes; they were not asked if they sold ugly produce or sell items close to expiration date at reduced cost because they are a school district. They indicated that reduction of the cost of discarding food waste would incentivize their institution to divert more unsaleable food toward donation than it currently does.

School Specific Questions: Institution reported that 10% of food waste is caused by the way food is prepared and handled and the remaining 90% of food waste is caused by students not eating all of their food. They indicated that the school district both makes its students aware of the implications of food waste through signage and actively encourages students to eat their whole lunch through signage and staff support. Students are not required to pick up foods from each food group. The school district reports having trade tables and using ‘smarter lunchroom techniques’. They report that fruits and vegetables are self-service. Institution also reports that lunches are cooked from scratch as opposed to the pre-pack and reheat method.

Appendix E: Survey Questions

Questions for All Stakeholder Groups: Grocery, Hospitals, K-12 Schools

Section 1: Institution Demographics

Institution Name: _____

Institution Location (Address if Applicable): _____

Institution Type:

Please select which best represents your institution

For-profit

Non-profit

Government

What is your institution?

Primarily a food retailer

Primarily a food wholesaler

Hospital

K-12 School

Section 2: Assessment of Food Waste & Food Donation

What happens to food products your institution has that are out of date?

Thrown Donated Used Other please specify _____

What happens to food products your institution has that are close to expiration?

Thrown Donated Used Other please specify _____

What happens to food products your institution has that have damaged packaging?

Thrown Donated Used Other please specify _____

What are the causes of unsaleable food for your institution?

- Food expiration _____
- Food that is almost out of date _____
- Damaged packaging _____
- “Ugly” produce _____
- Past Season/Left over after a holiday _____

- Other (please specify) _____

Please list what factors contribute most to the quantity of unsaleable food at your institution.
(Free response)

Does your institution currently donate unsellable food to food banks? (Any chance we could have a criteria added of saying “healthier foods” like fruits/veggies/meats/dairy/whole grain products?)

Yes_No_Unsure _____

**Questions in blue only asked if participants said “Yes” to donating to food banks.*

Which food bank(s)? _____

Does your institution use any type of donation matching technology/software? Yes__ No__

If yes, what type of technology/software does your institution use? _____

What percentage of food donations currently are processed foods? (Like pastries, breads, etc.)
____%

Does your institution currently donate the following less-processed foods to food banks?

Fruits__ Yes__ No__ ____%

Vegetables__ Yes__ No__ ____%

Meats__ Yes__ No__ ____%

Dairy__ Yes__ No__ ____%

Whole grain products__ Yes__ No__ ____%

What is the total weight in pounds OR dollar amount (i.e., total retail value) of unsaleable food donated **for human consumption** by all of your institution’s operations during an average month? If you do not know the exact amount, please provide as accurate an estimate as possible. (You only need to answer in one of the units below)

Dollars _____

Pounds (Weight) _____

Please select the number that represents how accurate your above estimate is. Number one means it is your best guess based on experience. Number five means that your answer is based on actual recorded measures that are believed to be very accurate.

1, 2, 3, 4, 5

What is the total weight in pounds OR dollar amount (i.e., total retail value) of unsaleable food donated for **animal consumption** (e.g., food to hogs) by all of your institution’s operations

during an average month? If you do not know the exact amount, please provide as accurate an estimate as possible. You only need to answer in one of the units below)

Dollars _____

Pounds (Weight) _____

Please select the number that represents how accurate your above estimate is. Number one means it is your best guess based on experience. Number five means that your answer is based on actual recorded measures that are believed to be very accurate.

1, 2, 3, 4, 5

What is the total weight in pounds OR dollar amount (i.e., total retail value) of unsaleable food **that is composted** by all of your institutions operations during an average month? If you do not know the exact amount, please provide as accurate an estimate as possible. You only need to answer in one of the units below)

Dollars _____

Pounds (Weight) _____

Please select the number that represents how accurate your above estimate is. Number one means it is your best guess based on experience. Number five means that your answer is based on actual recorded measures that are believed to be very accurate.

1, 2, 3, 4, 5

Section 4: Institution Thoughts on Food Waste & Food Donation

Do you know about the Bill Emerson Good Samaritan Food Donation Act (linked)? Yes_No

If no, [display explanation of the act]:

Does your newfound knowledge of this act make your institution more likely to donate?

Yes_____No_____

If yes, does your knowledge of this act make your institution more likely to donate?

Yes_____No_____

How important is it to your institution to reduce food waste? (1 - Not at all important; 2 - Slightly important; 3 - Moderately important; 4 - Very Important; 5 - Extremely important)

Does your institution have an expressed commitment to reducing food waste? Yes _____No _____

Does your institution use “ugly” produce (produce with blemishes) in premade dishes? Yes ____
No ____

Do you sell items that are close to expiration for a reduced rate? (**Note: This question not asked to K-12 schools**)

Would any of the following incentivize your organization to divert more unsaleable food toward donation than it currently does? (Check all that apply)

- Tax incentives ____
- Publicity with the market/community ____
- Publicity with corporate headquarters (if applicable) ____
- Strengthening employee engagement/culture ____
- Strengthen relationships with local businesses/nonprofits ____
- Reduction of the cost of discarding food waste ____
- Increase differentiation (i.e., making your business stand out against others) ____
- Strengthening the likelihood that people will reciprocate when they can afford it (i.e., people your business donated to may buy more from your business in the future) ____

Section 5: Ramsey County Related Questions & Conclusions

Would your institution be interested in working with Ramsey County to reduce/divert food waste from your institution? Yes ____ No ____

Would you be willing to have Ramsey County contact your institution/organization for the purposes of creating a partnership to help reduce food waste? Yes ____ No ____

Would you be willing to be contacted for a brief interview with more questions? Yes ____ No ____

Since you selected yes to one or more of the questions above, please let us know who Ramsey County should contact: (**Note: This question only given if said yes to one of the three questions above**)

Full Name: _____
Position in Company: _____
Phone Number: _____
Email: _____

Does your institution know about BizRecycling? Yes ____ No ____

Does your institution currently use BizRecycling? Yes ____ No ____

One of the central goals of this survey is to help diagnose food waste in Ramsey County. Please indicate your willingness to allow Ramsey County to use the information you provided to us in this survey as a case study in any subsequent reports. Institution identifying information and survey responses would be subject to disclosure. However, contact information and the name of you, the survey taker, would not be published in any report. (Select one)

My institution consents to being a case study for Ramsey County_____

My institution **does not** consent to being a case study for Ramsey County_____

My institution might consent to being a case study, but you would need to contact the following person to request permission (please provide name **and** email or phone number)_____;

Is there anything else related to food waste in your institution that you would like us to know about? (Open response)

Questions for Grocery Stores Only

Section 1: Institution Demographics

Is your institution part of a chain?

If yes, is it a local chain, regional chain, national chain, or international chain?

Approximately how many customers does your institution serve on an average day?

Approximately how many employees does your institution have?

Section 4: Institution Thoughts on Food Waste & Food Donation

Does your institution sell or offer “ugly” produce (produce with blemishes)? Yes____No ____

Section 3: Barriers to Food Diversion

To what degree are each of the following barriers, either internal or external, that hamper your institution’s ability to reduce unsaleable food? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier, N/A - Unknown)

Stock management (e.g., large inventories, full shelves, improper stock rotation, etc.)

Forecasting errors

Improper handling of food (e.g. over-handling, improper temperature, lengthy transportation, disruptions to cold chain, etc.)

Displays (e.g. excessive product displayed to create an effect of abundance)

Overproduction of prepared food (e.g. food not used because it is close to its expiration date)

Expiration date labels (e.g. not enough staff to prepare food/rotate stock, poor training for handling food, etc.)

Promotional products (e.g. failure of promotional/holiday food items to sell)

Staffing challenges (i.e. unpredictable factors make inventory planning difficult)

Sales fluctuations

Insufficient refrigeration and/or storage on site

Knowledge about best ways to reduce food waste

Packing & Packaging (e.g. packing methods that affect shelf life, packing where grouped products need to be discarded if one item goes bad, inflexible case sizes, etc.)

Other barriers (please list)

To what degree are each of the following barriers, either internal or external, that prevent your company from donating unsaleable food for human consumption? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier)

Legal liability concerns

Regulatory constraints

Improper handling of food at your institution (e.g. over-handling, improper temperature, lengthy transportation, disruptions to cold chain, etc.)

Insufficient refrigeration and/or storage on site

Insufficient refrigeration and/or storage at Food Bank

Transportation constraints to donation (e.g., distance, fleet, etc.)

Time it takes to donate

Knowledge about best ways to donate unsaleable food

Other barriers (please list)

To what degree are each of the following barriers, either internal or external, that hamper your institution's ability to compost unsaleable food waste and other organics? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier)

Insufficient recycling businesses in the community

Monetary constraints to recycling organics

Transportation constraints to recycling (e.g., distance, fleet, etc.)

Time constraints

Knowledge about best ways to recycle food waste

Other barriers (please list)

Questions for Hospitals Only

Section 1: Institution Demographics

Approximately how many patients and customers does your institution serve on an average day?

Approximately how many food service employees does your institution have?

Section 2: Assessment of Food Waste & Food Donation

Approximately what percentage of your institution's food waste is caused by the way food is prepared and managed (e.g., overproduction, kitchen practices, given portions, stock management, etc.)? ____%

Approximately what percentage of your institution's food waste is caused by patients or customers not eating all of their food? ____%

If your answers to the two questions above do not equal 100%, what are other things that contribute to the cause of food waste in your institution? _____

Section 3: Barriers to Food Diversion (options differ for hospitals)

To what degree are each of the following barriers, either internal or external, that hamper your institution's ability to reduce unsaleable or unusable food? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier, N/A - Unknown)

Stock management (e.g., large inventories, full shelves, improper stock rotation, etc.)

Forecasting errors

Improper handling of food (e.g. over-handling, improper temperature, lengthy transportation, disruptions to cold chain, etc.)

Overproduction of prepared food (e.g. food not used because it is close to its expiration date)

Expiration date labels (e.g. not enough staff to prepare food/rotate stock, poor training for handling food, etc.)

Staffing challenges (i.e. unpredictable factors make inventory planning difficult)

Sales fluctuations

Insufficient refrigeration and/or storage on site

Knowledge about best ways to reduce food waste

Packing & Packaging (e.g. packing methods that affect shelf life, packing where grouped products need to be discarded if one item goes bad, inflexible case sizes, etc.)

Expansive menu options (e.g. extended menu options that complicate inventory management and require more ingredients to be kept on hand)

Rigid management (e.g. managers not allowed to adjust for local demand or use inventory creatively, there are institutional guidelines for how long food can sit before it is discarded, etc.)

Other barriers (please list)

To what degree are each of the following barriers, either internal or external, that prevent your company from donating unsaleable or unusable food for human consumption? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier)

Legal liability concerns

Improper handling of food at your institution (e.g. over-handling, improper temperature, lengthy transportation, disruptions to cold chain, etc.)

Insufficient refrigeration and/or storage on site

Insufficient refrigeration and/or storage at Food Bank

Transportation constraints to donation (e.g., distance, fleet, etc.)

Time constraints

Knowledge about best ways to donate unsaleable food

Other barriers (please list)

To what degree are each of the following barriers, either internal or external, that hamper your institution's ability to compost unsaleable or unusable food waste and other organics? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier)

Insufficient recycling businesses in the community

Monetary constraints to recycling organics

Transportation constraints to recycling (e.g., distance, fleet, etc.)

Time constraints

Knowledge about best ways to recycle food waste

Other barriers (please list)

Questions for K-12 Schools Only

Section 1: Institution Demographics

Approximately how many students does your school serve food to on an average day?

Approximately how many food service employees does your institution have?

Section 3: Barriers to Food Diversion (options differ for schools)

To what degree are each of the following barriers, either internal or external, that hamper your institution's ability to reduce unused food? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier, N/A - Unknown)

Stock management (e.g., large inventories, full shelves, improper stock rotation, etc.)

Forecasting errors

Improper handling of food (e.g. over-handling, improper temperature, lengthy transportation, disruptions to cold chain, etc.)

Overproduction of prepared food (e.g. food not used because it is close to its expiration date)

Expiration date labels (e.g. not enough staff to prepare food/rotate stock, poor training for handling food, etc.)

Staffing challenges (i.e. unpredictable factors make inventory planning difficult)

Insufficient refrigeration and/or storage on site

Knowledge about best ways to reduce food waste

Packing & Packaging (e.g. packing methods that affect shelf life, packing where grouped products need to be discarded if one item goes bad, inflexible case sizes, etc.)

Expansive menu options (e.g. extended menu options that complicate inventory management and require more ingredients to be kept on hand)

Rigid management (e.g. managers not allowed to adjust for local demand or use inventory creatively, there are institutional guidelines for how long food can sit before it is discarded, etc.)

Lunchroom restrictions (e.g. lack of practices that encourage lunch to be eaten, lack of well-timed lunch periods, not allowing students to choose components of meals, etc.)

Students taking larger portions than they can eat

Other barriers (please list)

To what degree are each of the following barriers, either internal or external, that prevent your company from donating unused food for human consumption? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier)

Legal liability concerns

Improper handling of food at your institution (e.g. over-handling, improper temperature, lengthy transportation, disruptions to cold chain, etc.)

Insufficient refrigeration and/or storage on site

Insufficient refrigeration and/or storage at Food Bank

Transportation constraints to donation (e.g., distance, fleet, etc.)

Time constraints

Knowledge about best ways to donate unsaleable food

Other barriers (please list)

To what degree are each of the following barriers, either internal or external, that hamper your institution's ability to compost unused food waste and other organics? (All answered on a scale: 1- Not at all a barrier; 2 - a small barrier; 3 - a common barrier; 4 - an extreme barrier)

Insufficient recycling businesses in the community

Monetary constraints to recycling organics

Transportation constraints to recycling (e.g., distance, fleet, etc.)

Time constraints

Knowledge about best ways to recycle food waste

Other barriers (please list)

Section S: School-Specific Questions

Approximately what percentage of your school's food waste is **caused by the way food is prepared and managed** (e.g., overproduction, kitchen practices, given portions, stock management, etc.)? ____%

Approximately what percentage of your schools food waste is **caused by students not eating all of their food**? ____%

If your answers to the two questions above do not equal 100%, what are other things that contribute to the cause of food waste in your school? (List)

Does your school make its students aware of the implications of food waste?

If yes, how do they educate their students on this topic?

Does your school actively encourage students to eat their whole lunch?

If yes, how do they encourage their students to do so?

Does your school require students to pick up foods from each food group?

Does your school have a trade table for unwanted food items brought from home or purchased?

Does your school try to have "smarter lunchrooms"?

To what degree does your school offer self-service for students to choose their own portions?

Most food is self-service _____

Some food is self-service _____

If selected, what food types/food groups are self-service?

No foods are self service _____

Does your school primarily use a pre-pack and reheat model to serve food or primarily a kitchen based model where food is cooked from scratch?

Pre-pack & reheat _____

Cooked from scratch _____

Appendix F: Works Consulted

Berkenkamp, J., & Phillips, C. (2017a). Modeling the Potential to Increase Food Rescue: Denver, New York City and Nashville. *NRDC*.

Buzby JC, Bentley JT, Padera B, Ammon C, Campuzano J. (2015). Estimated Fresh Produce Shrink and Food Loss in U.S. Supermarkets. *Agriculture*, 5(3):626-648.

Buzby, Jean C. and Farah-Wells, Hodan and Hyman, Jeffrey, The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States (February 1, 2014). USDA-ERS Economic Information Bulletin Number 121. Available at SSRN: <https://ssrn.com/abstract=2501659> or <http://dx.doi.org/10.2139/ssrn.2501659>.

Buzby, Jean C. & Wells, Hodan Farah & Axtman, Bruce & Mickey, Jana. (2009). Supermarket Loss Estimates for Fresh Fruit, Vegetables, Meat, Poultry, and Seafood and Their Use in the ERS Loss-Adjusted Food Availability Data. *Economic Information Bulletin 58313, United States Department of Agriculture, Economic Research Service*.

Frasz, D., Morris, H., Abbe, R., Mourad, M., & Rehberger, E. (2015). Food Rescue Services, Barriers, and Recommendations in Santa Clara County. *FoodShift*
<<https://www.sccgov.org/sites/rwr/rwrc/Documents/FoodShiftFinalReport.pdf>>

Free Open Source Software Is Costing Vendors \$60 Billion," New Standish Group International Study Finds. (n.d.). Retrieved from <http://www.marketwired.com/press-release/free-open-source-software-is-costing-vendors-60-billion-new-standish-group-international-844462.htm>.

Gunders, D., Bloom, J., Berkenkamp, J., Hoover, D., Spacht, A., & Mourad, M. (2017b) Wasted: How America is Losing up to 40 Percent of its Food from Farm to Fork to Landfill. *NRDC*.

K. Ven, J. Verelst and H. Mannaert, "Should You Adopt Open Source Software?," in *IEEE Software*, vol. 25, no. 3, pp. 54-59, May-June 2008.
doi: 10.1109/MS.2008.73

Leib., E. B., Chan, A., Hua, A., Nielsen, A., Sandson, K. (2018) Food Safety Regulations & Guidance For Food Donations: A Fifty-State Survey of State Practices. *Harvard Law School Food Law and Policy Clinic*.

Leib, E. B., Rice, C., Berkenkamp, J., & Gunders, D. (2017). Don't Waste, Donate - Enhancing Food Donations Through Federal Policy. *Harvard Law School Food Law and Policy Clinic & NRDC*.

Managing and Transforming Waste Streams: A Tool for Communities. United States Environmental Protection Agency. <https://www.epa.gov/transforming-waste-tool/managing-and-transforming-waste-streams-tool>

Marc F. Bellemare, Metin Çakir, Hikaru Hanawa Peterson, Lindsey Novak, Jeta Rudi. (2017) On the Measurement of Food Waste. *American Journal of Agricultural Economics*, Volume 99, Issue 5, Pages 1148–1158, <https://doi.org/10.1093/ajae/aax034>

Papargyropoulou, E., Lozano, R., Steinberger, J. K., Wright, N., & bin Ujang, Z. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of Cleaner Production*, 76, 106-115.

Salemdeeb, R., zu Ermgassen, E. K., Kim, M. H., Balmford, A., & Al-Tabbaa, A. (2017). Environmental and health impacts of using food waste as animal feed: a comparative analysis of food waste management options. *Journal of cleaner production*, 140, 871-880.

Streeter, V., & Platt, B. (2017). Biocycle Nationwide Survey Preview: Residential Food Waste Collection Access in the US. *BioCycle*.

Thyberg, K. L., & Tonjes, D. J. (2016). Drivers of food waste and their implications for sustainable policy development. *Resources, Conservation and Recycling*, 106, 110-123.

Vaneesha Duseruth, Hikaru Hanawa Peterson & Jennifer Schmitt. (2018). Estimating a Local Food Waste Baseline. *Journal of Food Products Marketing*, 24:5, 654-680, DOI: 10.1080/10454446.2018.1472698

What is open source? (n.d.). Retrieved from <https://opensource.com/resources/what-open-source>.

(2014) Analysis of U.S. Food Waste Among Food Manufacturers, Retailers, and Restaurants. *BSR*.