AN ANALYSIS OF LOCAL GOVERNMENT INTERVENTIONS FOR EDIBLE FOOD RECOVERY

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MASTER OF PUBLIC POLICY AND ADMINISTRATION

by

Stephen Reitenour Myers

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FOR EDIBLE FOOD RECOVERY

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Department of Public Policy and Administration

Abstract

of

AN ANALYSIS OF LOCAL GOVERNMENT INTERVENTIONS

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This thesis explores public policies that have the potential to meet the 20% statewide edible food recovery mandates of SB 1383. This policy became law in 2016 as part of a broader effort to curb methane emissions, of which about a fifth is attributable to landfilled organic waste. While there have been significant successes at the city level across the nation, and while there are promising models at the county and regional level in California, a statewide edible food recovery mandate is unprecedented, and has the potential to throw local food distribution and waste hauling systems into chaos if not adequately designed and managed.

The overall goal of this thesis is to identify policies that can enable local jurisdictions to meet their statutorily-required edible food recovery amounts with reasonable expenditures of money and effort. To make these determinations, I used Bardach's (2012) analytical research method, the "Eightfold Path," to develop a list of policy alternatives and criteria by which to assess them. The resulting analysis allowed me to plot alternatives along one axis of a table and criteria along the other, creating a "Criteria Alternatives Matrix," or "CAM" for short.

I analyzed four policy alternatives that the literature and my conversations with stakeholders in the waste management and food recovery fields recommended, and determined that one of the four policies have a relatively high likelihood of success according to the five criteria by which I evaluated each. I also determined that two other complementary alternatives could also be successful. The use of software to match donors and recovery organizations with on-the-spot transporters for time-sensitive donations was the top-ranked alternative, with (1) utilization of public health inspectors to promote recovery among regulated food distributors and (2) facilitation of planning and coordination between donors, recovery organizations, and transporters as equally-ranked complements. I recommended the implementation of donation-matching software as the strongest option to address the issue, but also indicated that some combination of the three could be particularly effective in facilitating edible food recovery in the near future.

_____, Committee Chair
Su Jin Jez, Ph.D.

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Date

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Chapter 1: Introduction

Edible food recovery is the process by which food that would otherwise be landfilled is rescued from the generator of potential food waste and delivered to an individual who can consume the food. The process can be as simple as an individual saving leftovers from a meal and offering it to a willing recipient. It may be as complex as deliveries of unsold produce from large-scale grocers to a distribution warehouse, which would coordinate with charitable food distribution organizations to sort and store the food for pick-up, or transport the food to locations that interface with needy families. Soup kitchens, churches, or housing communities would then distribute the food to their communities.

While edible food recovery has long been a charitable activity to reduce hunger at the local level, the state has entered into promotion of recovery as a tool to combat methane emissions created by landfilled food. Recovery, therefore, is one of many interventions in a comprehensive legislative framework aimed at slowing climate change. Faced with the looming threat of ecological, social, and economic disaster as a result of global climate change, California political leaders have made reductions to greenhouse gas (GHG) emissions a major statewide policy priority (Ramanathan et al., 2016). Over the past fifty years, the state has made significant reductions in emissions of airborne pollutants (Ramanathan et al., 2016). Policy makers have given the most attention to carbon dioxide (CO_2) because climate scientists have found that increased presence of the gas in Earth's atmosphere is the most significant contributor to climate change since the onset of the Industrial Revolution (Union of Concerned Scientists, n.d.). CO_2's

abundance in the atmosphere, and the extended period it takes for the gas to break down, means that it has the largest impact on the greenhouse effect (Union of Concerned Scientists, n.d.). However, recent policymaking in California has focused on Short-Lived Climate Pollutants (SLCP) such as methane, because while they have a much shorter lifespan and their quantity in the atmosphere is less than CO_2, their heat-trapping potential is greater while in the atmosphere (Union of Concerned Scientists, n.d.). Food waste produces a fifth of statewide methane emissions (California Air Resources Board [CARB], 2017), and is therefore an important focus of current policy.

In addition to the negative consequences food waste has on the environment by way of methane production, it also contributes to other significant problems. World food demand is projected to double between 2005 and 2050, and it is imperative that food systems become more efficient to use as few resources as possible in feeding as many people as possible (Gunders, 2017). Unfortunately, current food systems waste precious resources; food that is grown but never eaten consumes about a fifth of US cropland, fertilizer use, and agricultural water (Gunders, 2017). In addition, food waste requires vast land resources. Discarded food comprises about a fifth of landfill space in the United States (Gunders, 2017). Finally, wasted food contributes to statewide hunger because it rots in landfills rather than feeding people as it is designed to do. The California Association of Food Banks [CAFB] (n.d.) found that California has a food insecurity rate of 12.5%, which translates into 4.9 million individuals, or one-in-eight people in California, not knowing from where their next meal will come. All the more troubling is

that the child food insecurity rate is 20.7%, meaning 1.9 million, or more than one in four children, may go to bed hungry each night in California (CAFB, n.d.).

Given that feeding needy people with food that would be otherwise disposed in the landfill is a "win-win" because it can make a positive social impact while at the same time edging the state closer to its greenhouse gas reduction goals, it is not surprising that the state incorporated recovery mandates into its larger plan to reduce GHG emissions. Recent legislation (SB 1383, Lara, Chapter 395, Statutes of 2016) set significant reduction goals for methane, and among a host of other interventions, charged the California Department of Resources Recycling and Recovery (CalRecycle) with implementation of regulations to divert the majority of existing food waste away from landfills. This makes sense given the fact that 20% of statewide methane emissions come from landfills (CARB, 2017). Instead of being dumped in the landfill, the statue requires food waste to go to more beneficial uses such as compost production and edible food recovery (CARB, 2017). The edible food recovery provisions of the statute require at least 20% of the edible food now landfilled to be recovered for human consumption by 2025 (CARB, 2017).

Besides prevention of food waste, feeding hungry people is the most effective use of excess food. The US Environmental Protection Agency developed a concept it calls the "Food Recovery Hierarchy" to guide efforts to reduce food waste (Gunders, 2017). Prevention is the most desirable intervention, as it typically offers the greatest economic benefits by reducing the cost of growing, handling, and ultimately disposing of the unused food (Gunders, 2017). It also has the greatest environmental benefits because of

the wasted water, pesticides and fertilizers, fossil fuels, and other resources required to bring food from the farm to the trash can could be saved for a beneficial purpose (Gunders, 2017). Feeding hungry people is the second most effective intervention, as it enables food to serve the purpose it was grown to fulfill (Gunders, 2017). In addition, it has other pro-social benefits such as reducing hunger for needy populations, generates goodwill between edible food donors and their communities, and can be motivating for employees and volunteers who transform food from potential waste to nourishment for the less fortunate (Gunders, 2017).

While edible food recovery is environmentally and socially beneficial, local implementation of the 20% requirements of SB 1383 will be fraught with legal and logistical challenges. This thesis uses Bardach's "Eightfold Path" policy analysis model to consider policy alternatives with which local governments can encourage food waste generators and recovery organizations to overcome barriers to food recovery and redirect the greatest portion of edible food from landfills to humans at the least cost, thus addressing both the climate change impacts of food waste and increasing access to food for the needy in California (Bardach, 2012). Bardach's method utilizes a "Criteria-Alternatives Matrix" (CAM) to compare several possible policy interventions (the Alternatives) through the lens of several different considerations (the Criteria). The resulting grid is the Matrix. Policymakers can use a CAM analysis to consider the various tradeoffs involved in complex policy issues; consider distinct considerations in isolation; weigh the relative advantages and disadvantages of a particular alternative in terms of possible risks, rewards, and costs; and come to a decision that can be more clearly

articulated (Bardach, 2012). While susceptible to the biases of its analyst, a CAM analysis is transparent in how it assigns relative importance to a given criteria and is flexible in that a given reader can modify the analysis to more closely reflect his or her priorities (Bardach, 2012).

The remainder of this chapter will define the scope of the food waste problem in California and introduce different types of interventions that can reduce food waste. It will close with a brief survey of existing approaches to recovery in different communities. Chapter two will address the political, economic, and social environment that shapes policy-makers' ability to enact meaningful interventions to recover more edible food. Chapter three will then begin the CAM analysis by presenting possible interventions used at the local level before narrowing the alternatives to a few particularly promising options. Chapter four will identify the criteria by which the different interventions will be evaluated, and give those criteria relative weight in order to inform the analysis in Chapter five. Chapter five will apply criteria to alternatives, confront limitations and trade-offs, and analyze the likely outcomes based on what is currently known. Chapter six will close the thesis by offering recommendations to local policy makers.

What is "Food Waste"?

Most everything that is alive has the potential to be food, so limiting the nature of what counts as "food" helps to clarify what is actually "wasted." The literature typically distinguishes between "food losses," which occur at the production and processing stages of the food chain, and "food waste," which occurs at the retail and consumer stages

(Gustavsson, Cederberg, & Sonesson, 2011). Food losses are more frequently attributable to a lack of infrastructure, such as transportation, storage, cooling, and market capacity, while food waste is more associated with behavioral issues of retailers and consumers (Gustavsson, et al., 2011). For example, retailers may overstock displays in order to send a message of abundance under the assumption that it increases sales, but throw out food left unsold, or may worry about potential liability if a food donation makes someone ill (Gunders, 2017). Consumers may be enticed by "buy one, get one" promotions to buy more food than they can consume, may improperly store food, leading to early spoilage, or may be confused by ambiguous or confusing date labels on products (Gunders, 2017).

Many scholars have created differing definitions of what constitutes "food waste." The Food and Agriculture Organization (FAO) of the United Nations defined "food waste" as "wholesome edible material intended for human consumption, arising at any point in the [food supply chain] that is instead discarded, lost, degraded or consumed by pests" (as cited in Papargyropoulou, Lozano, Steinberger, Wright, & bin Ujang, 2014, p. 108). Tristram Stuart (2009) includes edible material that is intentionally fed to animals, or is a "by-product of food processing diverted away from the human food chain" (as cited in Papargyropoulou, et al., 2014, p. 108). Smil (2004) adds over-nutrition, the difference between the calories that are consumed and those that are needed for adequate nutrition per capita. ReFED (2016b) includes cosmetically imperfect crops that, while typically are not disposed of in landfills because they may be retilled into the soil, are capable of being recovered for human consumption. This constitutes 16% of the food waste estimated by ReFED that is generated in the U.S. each year (ReFED, 2016a). This

means that under the FAO definition, approximately a third of global post-agricultural food production is never consumed by humans, while under the ReFED definition, the percentage of food loss in the U.S. is closer to 40 (Gustavsson, et al., 2011; ReFED, 2016a). This framing of "food waste" to include crops on farms that gets tilled into the soil could be important if the ultimate goal were to maximize the total amount available to be recovered, and in fact has been a significant strategy to increase recovery of fresh produce in California (McGray, 2009). However, because the thrust of SB 1383 is to reduce methane emissions, and produce tilled back into the soil is not a problem in terms of methane production. As a result, farm-level recovery was not included in the legislation.

This variety in the way researchers define the problem influences policy makers' understanding about where in the stages of production and consumption the problem actually arises, and informs the types of interventions a society may choose to undertake. If a significant portion of loss happens at the farm, for instance, those interventions will look very different than if the loss is happening in a commercial kitchen or with otherwise edible food that households choose to put in the trash. In other words, it is important to define what the problem is in order to fashion an appropriate solution. Because the goals of SB 1383 are to reduce the methane emissions caused by landfilled food waste, only that food waste that causes methane emissions should be included in the baseline amount used to calculate the percentage of reduction required.

It is important to acknowledge that in addition to the scientific considerations discussed above, the agency's standards are also open to political considerations. As will

be discussed in chapter two, because CalRecycle creates its regulations in consultation with regulated entities, it is susceptible to "agency capture," where the regulated parties can influence the laws under which they are regulated. In its draft form, the Department defines "edible food" as "unsold or unserved food that is fit for human consumption, even though the food may not be readily marketable due to appearance, age, freshness, grade, size, surplus, or other conditions" (CalRecycle, 2019, p. 4). This definition will likely guide recovery efforts mandated by state law, so it is the definition I will use throughout this thesis.

What is the scope of the food waste problem in California?

CalRecycle, which tracks statewide disposal rates, confirmed in their 2015 analysis that food waste is a significant portion of both residential and commercial waste streams in California – overall, about 18% of waste in California landfills is food waste, and an even greater percentage of waste from commercial generators (24%) is food (CalRecycle, 2015a, 2015b). The department conducted two Waste Characterization Studies in 2014, and both resulting reports identified quantities of food waste from various sectors (CalRecycle, 2015a, 2015b). The Disposal Facility Based Study gathered data at landfills (CalRecycle, 2015b). While this method allowed the department to know the source of the waste, the categories were determined by the type of hauler rather than the actual producer of the waste (CalRecycle, 2015b). The Generator Based Study gathered data at source sites, allowing the department to know more detail about which generators produced which kinds of wastes and in what quantities (CalRecycle, 2015a).

This study, however, excluded single-family residences (CalRecycle, 2015a). See appendix A for detailed results of both studies.

Analysis of the statewide disposal rates is helpful in understanding where efforts to reduce food waste may be the most effective. Some business types are particularly appropriate for attention, such as restaurants, because they not only produce a significant amount of waste (2,876,653 tons), but also because a significant percentage of that waste is food waste (51%) (CalRecycle, 2015a). However, even though food waste is only a small percentage of overall waste for Professional Services (8%), the fact that it is the largest producer of waste (at 3,994,643 tons) means that the industry is still fourth on the list of producers. Retail (besides Food and Beverage), Management Services, and Arts, Entertainment, and Recreation complete the top five producers of food waste. Though not producers of as much waste, other industries merit attention because of their high percentage of food waste, including Food and Beverage Retail (42%), Food Manufacturers (38%), Educational Institutions (34%), and Hotels (32%).

It is important to note that these studies occurred in 2014, well before the Department drafted its definition of "edible food" for the purposes of SB 1383. For example, the amounts from 2014 include all food waste, not just edible waste, so the quantities include rotten food, eggshells, and banana peels that would never be recoverable, meaning the amounts do not really inform how much edible food needs to be recovered in order to meet statutory mandates.

The Department has not yet conducted a study to determine the statewide baseline amount that will guide implementation of SB 1383. Once the Department issues final

regulations that includes its definition of "edible food," it will then be able to establish how much food that meets the definition is actually being thrown away. The amounts in prior waste characterization studies, therefore, need to be seen as a guidepost, rather than definitive.

What interventions have been successful?

Small-scale interventions have been successful across the nation. It is important to note, however, that these programs are typically at the city level. The present challenge is to create a sustainable system statewide in California, in both urban and rural areas. Many variables inform how successful a recovery system may be, including the density of the population, the dedication of the community to the goal of recovery, the financial incentives to food waste generators, the fear of liability by generators and recovery organizations alike, local health and safety laws that govern donations, and the labeling systems that nudge generators to dispose of edible food. Below are a few examples from various jurisdictions that help to highlight some of the alternatives that will be discussed in this thesis:

Boulder, Colorado has an organization called Boulder Food Rescue which uses a fleet of bikes and trailers, along with a team of hundreds of volunteers, to provide just-in-time food delivery from participating grocers to transport perishable fruits and vegetables to day shelters, food pantries, and community centers. It also serves as a resource for housing sites, after school programs, and preschools to help create no-cost grocery programs in order to create food security for their participants (Boulder Food Rescue, n.d.).

In *Tennessee*, the Natural Resources Defense Council (NRDC) created a program called the Nashville Food Waste Initiative (NFWI) to bring together stakeholders such as businesses, governmental leaders, and residents to evaluate food waste in the city and create surveys for residents in order to understand the causes of waste (Cabrera, 2017). The initiative equips businesses with a waste-tracking software package that helps commercial kitchens better understand where their waste comes from with the objective of reducing excess ordering (Cabrera, 2017). NFWI also sponsors educational outreach in the form of screenings of documentary films, panels, and stakeholder meetings and partnered with the mayor of Nashville to engage with local restaurants to reduce their waste and donate more food to local non-profit organizations (Cabrera, 2017). In the city of Memphis, a program doubles incentives for Supplemental Nutrition Assistance Program (SNAP) participants when they shop at local farmers' markets and Kroger grocery stores, and developed a network of over 60 community gardens, with many located in food-insecure neighborhoods (Cabrera, 2017).

Washington State provides guidance to potential food donors through its Department of Health that says "[l]icensed food establishments are encouraged to donate surplus foods" and "[f]ood processors are encouraged to donate foods that may not meet their specifications for reasons that do not affect food safety, such as package printing errors." Explicit governmental support for donations can help potential donors feel confident about making donations (Broad Leib, et al., 2016).

Santa Clara, California partners with an organization called Food Shift, which conducts research on the local food system and offers suggestions to overcome barriers to

donation (Frasz, Morris, Abbe, Mourad, & Rehberger, 2015). The organization also partners with local social service organizations to train and employ individuals in food rescue organizations who are overcoming addiction or have been released from incarceration (Food Shift, n.d.).

San Francisco, California partners with local food banks, haulers, and end users to encourage diversion of food waste. At the turn of the century, the city was already providing substantial grant money to facilitate food recovery infrastructure, supporting the local food bank to expand its collection capacity by subsidizing a refrigerated truck and a driver's partial salary as well as a conveyer system to sort food. The city also worked with local farmers to divert edible food unfit for human consumption to their animal feed lots (California Integrated Waste Management Board, 2001).

Orange County, California has developed a collaborative strategy that coordinates the resources and efforts of multiple entities: food recovery organizations, businesses, local governments, and health inspectors to work together on food recovery (Goldstein, 2016). The lead organization, Waste Not Orange County [WNOC], positioned itself to be the point organization through which large grants flow out to the various organizations participating in food recovery. It has leveraged relationships with local public health officials to promote food recovery while inspecting restaurants and developed outreach materials that those officials can distribute (Goldstein, 2016). WNOC has partnered with a local taxi company to provide on-demand food rescue. It has worked with local health care providers to screen their patients for food insecurity, and developed a location-based local map that allows medical offices to identify the closest food pantry to the patient

(Goldstein, 2016). The coalition created Food Recovery Task Forces in local cities that are led by restaurant owners who can bridge the gap by building understanding between health inspectors and local food generators to help them transition into food recovery (Goldstein, 2016). The coalition also sought and received both local and state funding to expand infrastructure such as refrigerated trucks and pay for staff time needed to run the program (Goldstein, 2016).

Structure of the Thesis

This chapter laid out the problem that food waste makes up somewhere between a fifth and a quarter of the solid waste in landfills statewide, and as a result, contributes about a fifth of the methane that is produced statewide. It touched on the different sources of food waste, and the different types of interventions that can impact food waste. The chapter then honed in on edible food recovery as an intervention. It surveyed existing approaches to recovery that have been used successfully in different communities. Chapter two will address the political, economic, and social environment that shapes policy makers' ability to enact meaningful interventions to recover more edible food. Chapter three will construct alternatives by narrowing the field of possible interventions to a few particularly promising options. Chapter four will explain the criteria by which the different interventions will be evaluated, and give those criteria relative weight in order to inform the analysis in chapter five. Chapter five will apply those criteria to the menu of interventions, confront the limitations and trade-offs of the alternatives, and analyze the likely outcomes based on what is known. Chapter six will offer a recommendation to policy makers in local government, who will be responsible for

meeting the recovery mandates of state law. It will offer suggestions for implementation of particular policies, and how intervention of two of the most promising policies together could work harmoniously to promote sustainable food recovery systems.

Chapter 2: Natural, Social, Political, Legal, and Economic Influences

Public policies and the governmental programs implemented to further their objectives exist within a complex array of influences and resistance that often determine the types of interventions that are feasible, as well as the degree to which they are supported by public and private investment of both time and resources. The success of any policy requires an understanding of these influences in order to evaluate to what degree the policy will be limited by constraints or buoyed by support of the surrounding environment. Effective policy implementation carefully weighs the factors of relative influence and attempts to minimize resistance while maximizing support. The following chapter examines the social, natural, economic, legal, and political environment that shape the state-mandated recovery of edible food in California. These factors inform the selection of criteria in chapter four, as well as inform how well a given alternative is likely to meet a given criteria when used to evaluate alternatives in chapter five.

In this chapter, I first explore the social environment that shapes public attitudes toward food waste recovery. I then briefly revisit the concerns about the natural environment that led to statewide regulation. Next, I discuss the economic structure of edible food recovery, including the various market forces that encourage the waste of perfectly edible food, and why there is insufficient demand to prevent such waste. Finally, I discuss the relevant political constraints and legislative framework that will guide edible food recovery in California and the impact they will likely exert on the feasibility of policy alternatives.

The Social Environment Surrounding Food Waste

Hunger in California

The effort of recovering food for human consumption rather than composting food waste only makes sense if there is an additional benefit in recovery that is not met by composting or other interventions that capture food before disposal: that benefit is hunger reduction. Feeding America, the largest hunger-relief organization in the U.S., measures the rate of hunger as "food insecurity," which is defined as "a household's ability to provide enough food for every person to live an active healthy life" (Feeding America, n.d.). Gundersen, Dewey, Crumbaugh, Kato, & Engelhard (2018) found that there is, indeed, a significant rate of food insecurity in California. They calculated that while the 11.7% rate of food insecurity in California is slightly lower than the U.S. national average of 12.3%, there are many counties, particularly rural ones, where the rate is as high as 17%, including Butte, Humboldt, Lake, Siskiyu, and Trinity counties. In addition, Gundersen, et al. (2018) found that while the highest meal costs tend to be higher in urban areas, costs also tend to be high in rural counties adjacent to a major metro area. For instance, the cost per meal was $4.61 in Nevada County, while the state average was $3.04 (Gundersen, et al., 2018; Feeding America n.d.). A high food insecurity rate, coupled with high food prices, means that while there may be higher-than-average median incomes for most families, those that are low-income have to dedicate a greater portion of their budget to feed their families (Gundersen, et al., 2018).

While recovery of edible food does have the potential to reduce hunger, it is also important to recognize that food recovery is not a cure-all. Caraher and Furey (2017)

contend that a focus on food recovery "depoliticizes" the issue of hunger and allows governments to ignore the gap between income and food costs (p. 18). It relegates low-income members of society to a demeaning second-tier status where they are only presented with food that no one else was willing to buy (Caraher & Furey, 2017). In fact, a focus on recovery rather than efficiency may promote excess wasteful surplus in the food supply chain as producers are incentivized to produce food for both the first-rate market and food bank demands as well (Caraher & Furey, 2017). Caraher and Furey emphasize that it should not be the duty of individuals and the non-profit sector to perform the social security functions of the government; rather the government should "provide the political leadership, courage, and conviction to address the structural causes of poverty and hunger..." (p. 18). The state's pressure on local governments and their food waste generators through legislation may be, therefore, somewhat misguided in that the state is using food recovery as a "bonus benefit" of organic waste diversion rather than a comprehensive hunger-alleviation strategy. In other words, while the state's efforts to address hunger through food recovery are better than doing nothing, addressing the larger problem of poverty that leads to hunger merits its own study and intervention, which are beyond the scope of this thesis.

Social Inertia

Any intervention to recover now-wasted edible food will take political will, funding, and changes in society's attitudes about food waste. Educating businesses and residents about rethinking disposal of organic waste will be a significant effort, as changing socially-accepted behavior is difficult to do, even with the provision of relevant

consequential information or economic incentives (Miller & Prentice, 2016). Edible food waste generators will need to be convinced of the benefits of organics diversion, or coerced by state and local government to change their behavior. As of now, edible food waste is an "invisible" problem. Stores quietly move edible food to the dumpster when they make the calculation that the food is no longer marketable, and have already factored in disposal costs as the price of doing business. Because the system works efficiently for businesses, they will be resistant to anything that takes more management and resources above and beyond what they already do. CalRecycle will necessarily need to build on existing partnerships with local governments, industry, nonprofits, local air districts and water boards to support regional planning efforts, identify ways to increase recovery of organics at the local level, and to develop capacity in order to transform what is now considered waste into a usable and commercially-viable product (CARB, 2017).

The Volunteer Culture of Food Recovery

Another important consideration is that for the most part, food recovery in the United States is based on the generosity of donors and food recovery volunteers. State mandates for food recovery may have perverse incentives on these mutually-beneficial relationships because it will likely create competition between organizations and change existing markets for food donations. Many volunteers may be offended by paid workers taking their "jobs," but they may also be unwilling or unable to take on the responsibility that full time employment requires.

Safety Concerns

There are significant public health risks associated with taking food that would otherwise go in the trash and redirecting it to a hungry person. In addition, the last thing a donor wants the public to know is that its food made someone sick. Regulations governing food donations are often created and enforced at the local level (ReFED, 2016a). Though the federal Food and Drug Administration (FDA) has a universal Food Code that loosely defines basic requirements for food safety, local health administrators often have differing interpretations of the rules. This leads to uncertainty on the part of potential donors, who may operate statewide but may be subject to different regulations in different cities and counties (ReFED, 2016a).

According to the Food Waste Reduction Alliance (2015), potential liability is a primary barrier to food donation by both manufacturers and retailers. However, federal and state legislation protects such donors from liability. The federal government implemented the Good Samaritan Food Donation Act to protect donors and food delivery organizations from civil and criminal liability stemming from illness caused by donated food unless the organization was grossly negligent or purposeful in its wrongdoing (ReFED, 2016a). Even so, many otherwise willing donors still balk at the potential backlash that could arise from food donations: retailers may be more worried about front-page news saying their food killed someone, even if that person does not take them to court (ReFED, 2016a). In addition, the law has yet to be tested in court, leaving corporate legal departments without precedent to help them ensure they are on solid legal footing when they advise their clients about donating food (ReFED, 2016a). State legislation (AB

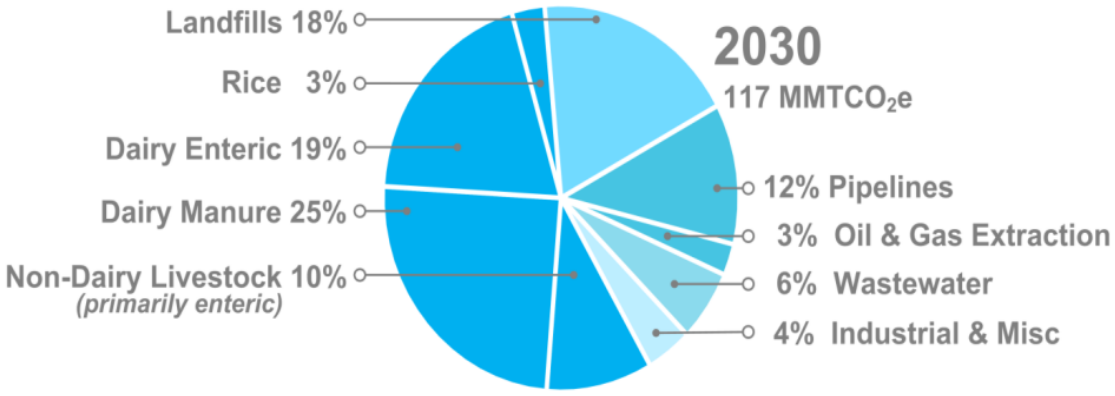
1219, Eggman, Chapter 619, Statues of 2017), the California Good Samaritan Act, expands the federal act's provisions to more potential donors, clarifies and requires health inspectors to educate businesses about the law. It is important to keep in mind, however, that even if there is no legal liability, word of mouth of food poisoning can be just as devastating to a business as a lawsuit.

Environmental Concerns Increase the Urgency of Recovering Food

As discussed in chapter one, while reducing hunger is a valuable goal of edible food recovery in its own right, legislation mandating edible food recovery was passed as a subset of solutions to address the state's emissions of methane, which are a significant contributor to climate change: by CARB's estimate, methane accounts for 20% of the current "climate forcing" of human activities (CARB, 2017, p. 7). Methane comes from a variety of sources; the most significant coming from agriculture. However, nearly one-fifth of methane emissions in California is attributable to organic waste that ends up in landfills (see Figure 1).

Figure 1

California's 2030 Methane Emission Sources with Existing Measures

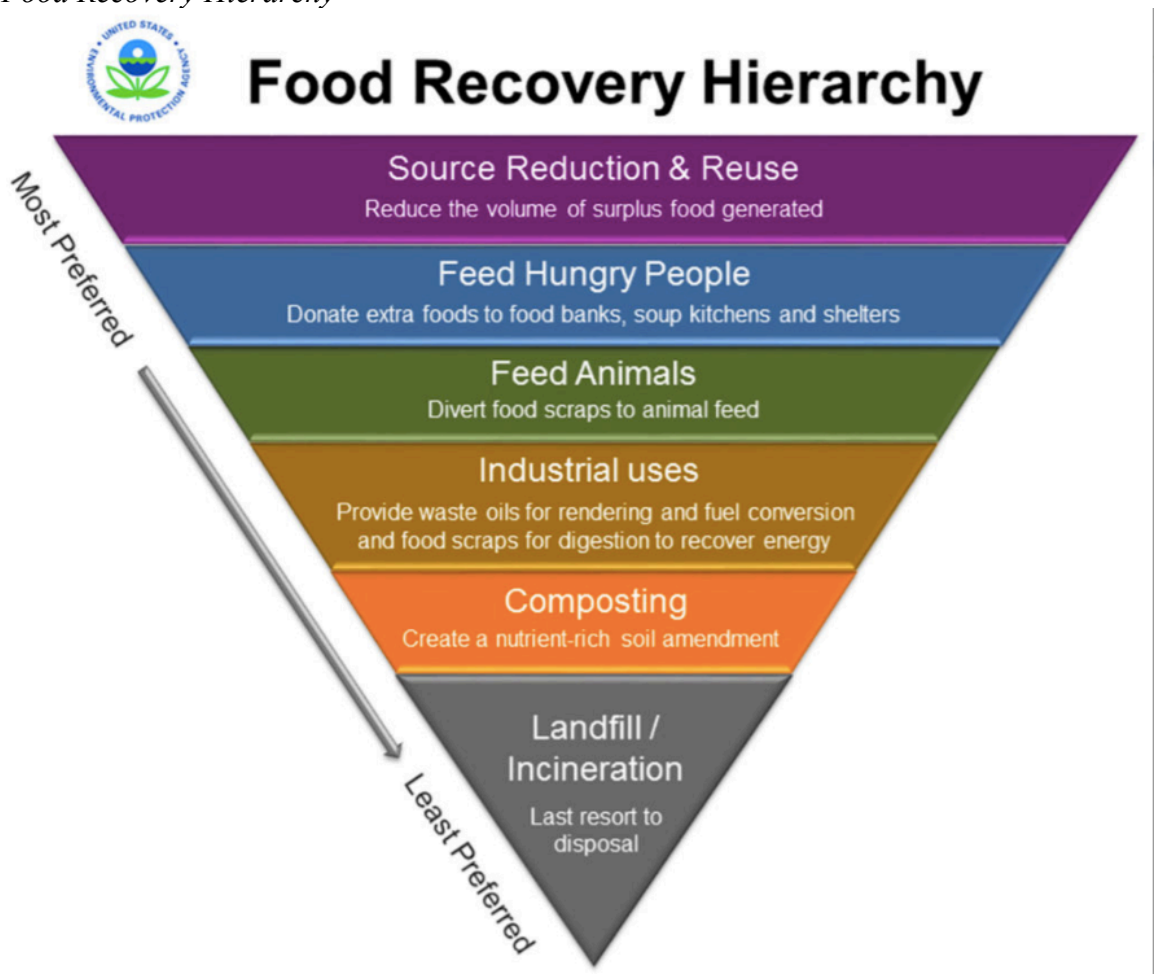


From *Short-Lived Climate Pollutant Reduction Strategy*, by California Air Resources Board, 2017, p. 61.

Because food waste has both social and environmental costs, organizations have prioritized uses of potential food waste based on both their social and environmental benefit. The US EPA's "Food Recovery Hierarchy" is a more detailed version of the familiar mantra "reduce, reuse, recycle," and guides stakeholders in evaluating interventions to reduce food losses and waste (see Figure 2). The tool allows stakeholders to appropriately prioritize interventions, because the hierarchy is organized with the strategies with the best potential to "create the most benefits for the environment, society, and the economy" (US EPA, n.d.).

Figure 2

Food Recovery Hierarchy



From "Food Recovery Hierarchy," by Wasatch Resource Recovery, no date (http://wasatchresourcerecovery.com/food-recovery-hierarchy/).

At the top of the list is "source reduction," which focuses on reducing the amount of surplus food generated. Next is "feed hungry people," which focuses on diverting food that would otherwise be landfilled to food rescue organizations so that it may be served to the needy. The third tier is "feed animals," which focuses on directing food waste to farm animals, which in turn convert that energy into food energy for humans. Next is industrial use, such as fueling anaerobic digesters with food waste to intentionally create methane,

but to capture the methane and use it for vehicle fuel or other uses. Towards the bottom is composting, which facilitates the food's natural process of changing from food to soil. The least desirable option is to dispose of the waste in a landfill or an incinerator. The state of California has chosen to focus on the second, fourth, and fifth tiers – feeding humans, industrial uses, and composting – in SB 1383.

The Economic Environment

In addition to social and environmental factors, economic factors also play an important role in the potential success of interventions considered to maximize edible food recovery. Economic factors include the highly competitive markets that retailers and restaurants operate in and the economics of waste hauling and disposal as it currently exists. Each of these economic factors are discussed below.

Edible Food Supply

Any policy alternative that is proposed to divert food otherwise headed for the trash to a recovery organization must operate within the state's market structure for food sale and disposal. This structure is best characterized as a free-market system that is vast, complicated, and driven by stiff competition between many providers of prepared and fresh food: grocers, restaurants, caterers, food-service operators such as hospitals and schools, and events such as sports games and concerts.

For the purposes of the proposed edible food recovery regulations, the supply of edible food waste begins with the above-mentioned producers. Unless the food waste generator has an existing relationship with a food recovery organization, the generator disposes of edible food waste in its dumpster along with all its other trash. From there, a

contracted hauler takes the waste to the landfill, where they pay a tipping fee to the landfill to dispose of the waste.

CalRecycle published a study in 2015 of "self-haul" rates at all 98 landfills across the state (CalRecycle, 2015c). Self-haul rates are those that the landfill charges individuals who bring their home- or business-generated waste to the landfill themselves. CalRecycle chose to compile self-haul rates because, even though self-hauled waste comprises only 20% of landfilled waste state-wide, the other 80% of waste is transported by dedicated solid waste haulers, subject to proprietary negotiated rates between haulers and their customers, or between haulers and the jurisdiction with whom they are contracted (CalRecycle, 2015c). Therefore, the Department is unable to provide statistically significant census of such negotiated rates. However, the Department was able to obtain a few such rates and included them in its report to provide an anecdotal narrative to help complete the picture (CalRecycle, 2015c).

The report found that tipping fees at a majority of landfills were between $36 and $50 per ton, but also found that the range included extremes from $0 to $125 per ton, and the distribution was asymmetrical (CalRecycle, 2015c). Of the 22 landfills that were willing to discuss negotiated rates, 20 said that they offered discounted rates for negotiated contracts (CalRecycle, 2015c). The median discount for such rates was $25 per ton (CalRecycle, 2015c). CalRecycle staff concluded that the $45 median for self-hauled waste was therefore likely higher than the cost to dispose of most waste in California (CalRecycle, 2015c).

The report also compared California's self-haul cost average ($54 – different from the median due to the irregularity of rates across the state) to other states and nations. It found that California's average was slightly higher than that of all other states ($49), but was significantly lower than the European Union's average of $100 per ton (CalRecycle, 2015c). Assuming that negotiated rates could be $25 lower than the $54 statewide average, it is safe to say that California waste haulers pay substantially less to dispose of waste than jurisdictions in other states, particularly those that are environmentally progressive and divert a significant portion of waste from the landfill, which is often more expensive to do than to simply landfill all waste (CalRecycle, 2015c).

Unlike the European Union, California has not taken policy steps that increase tipping fees or landfill taxes to dis-incentivize landfilling (CalRecycle, 2015c). California's low landfill rates, therefore, make it economically attractive to dispose of food waste rather than divert it for food rescue or other purposes. On the other hand, given the mandates of SB 1383 to either divert food for human consumption or to alternate uses like compost, food recovery may be incentivized if it is less expensive to implement than other alternatives.

For instance, a consultant for one county's food recovery effort said that in Orange County, landfill fees were $36 per ton, while diversion for compost cost $70 per ton and anaerobic digestion cost $110 per ton (M. White, personal conversation, Oct. 15, 2018). She suggested that even a small price differential of $10-20 between the cost of compost and the cost of recovery might be enough to encourage generators to choose

recovery over other disposal options, at least for that portion of waste that the generator could no longer send to the landfill.

Economics of Food Recovery

The other part of the economics of food recovery is the cost to do something other than dispose of the food waste. These costs include transportation, storage, preparation, and getting the food to needy people (or transporting the needy to the food). It also includes all the staff time required to coordinate the handoff, both by the generator and the recovery organization. While SB 1383 included a provision that allows local governments to collect fees to offset the jurisdiction's costs incurred in complying with the regulations enacted pursuant to the bill, no dedicated source of funding was established by the bill. This means that whatever fees are collected from generators will likely result in higher prices being passed on to consumers.

In addition to adding a layer of cost and responsibility onto generators, expanded food recovery also puts pressure on recovery organizations to expand their operations. As charitable organizations, most food banks spend significant amounts of time wrangling volunteers and appealing for donations to pay for transportation and storage of food. If generators feel pressured to shift currently landfilled food to recovery organizations, but the jurisdiction has not made adequate investments in recovery infrastructure, the donees may have much more supply of food without the necessary transportation and storage facilities to handle it. If local governments take their responsibility to recover food seriously, they will likely need to create funding mechanisms that help avoid "food

dumping" that lead to waste, and perhaps even sanctions against non-profits that become edible food waste generators themselves.

The Political Environment

In addition to social and economic constraints, it is important to consider the political climate in California as it relates to food waste recovery. Because CalRecycle is subject to the political priorities of the state administration, particularly the Governor, the political environment is critical to understanding what policies are likely to gain the most traction and meet the least resistance. Fortunately for proponents of food recovery, the state of California has been aggressive in its approach to tackling climate change, which benefits food recovery to the extent that it is a relatively cost-effective way to reduce methane production by food waste.

It may seem somewhat foolish for a lone state to attempt to tackle the global impact of climate change, since real change requires global cooperation and mutual accountability to address the problem comprehensively. However, statewide institutions such as the University of California, in collaboration with former Governor Brown, have made addressing climate change an important priority in the coming years. In the University's report, "Bending the Curve," Ramanathan, et al. (2016) suggest that the state "can serve as a living laboratory for 'the art of the possible'" by developing cutting-edge practices that can be shared with other states and nations to inspire them to innovate and share their successes as well (p. 7).

It is particularly important for states to take decisive action to address climate change in the current political environment in which the federal government has retreated

from earlier commitments to addressing climate change. While President Trump has expressed his intent to withdraw from the 2015 Paris Agreement to reduce global greenhouse gas emissions, Governor Brown has joined with other state administrators to form the U.S. Climate Alliance, with the aim of doing their part to achieve the Paris Agreement's goals (United States Climate Alliance, n.d.). The Governor was one of the co-chairs of the Global Climate Action Summit in September of 2018, which brought together leaders from across the globe to assess current efforts to combat emissions and build momentum toward future actions (Global Climate Action Summit, n.d.). California has also sued the U.S. Environmental Protection Agency to prevent revocation of fuel efficiency standards and oppose federal expansion of offshore drilling in the Pacific Ocean (Office of Governor Edmund G. Brown, 2018).

Given that the current governor of California is Gavin Newsom, who is also a Democrat and is more progressive than Governor Brown on some issues, California's commitment to reducing GHG emissions through efforts such as food recovery are likely to continue. The Department in charge of implementing the plan is CalRecycle, which is a branch of the California Environmental Protection Agency. It is headed by a Director who is appointed by the Governor. Therefore, it is quite likely that at the statewide level, support for food recovery efforts will continue.

As for actual implementation of food recovery at the local level, however, there may be significantly more political resistance. Even if the Department and the Legislature are aligned, that does not mean that local governments, who must do the actual work to reduce food going into landfills, will agree that food waste is even a problem. Those local

governments, as well as the generators that will be subject to the food recovery requirements, may be able to put sufficient pressure on the Department through the rulemaking process that the impact of SB 1383 could be minimized. For instance, as mentioned in chapter one, if lobbying efforts by municipalities and food waste generators narrow the definition of "edible food" or influence the baseline study that determines how much edible food is currently being landfilled, this would weaken the regulations and reduce the amount recovered.

CalRecycle has spent the past year gathering input from stakeholders such as local governments and food waste generators to help it shape the regulations. This input is beneficial on the one hand, because it enables the Department to realize the legislature's intent with the least amount of negative consequences for local jurisdictions, which are responsible for the actual implementation of the policy. On the other hand, it opens the Department to "agency capture," where the regulated entities can weaken the implementation of the policy and reduce its potential benefits. Local jurisdictions may also actively resist whatever regulations are implemented, with the hope that CalRecycle lacks the resources to effectively coerce jurisdictions across the state to comply.

SB 1383 is an unfunded mandate by the state government on localities, which are generally prohibited by the California Constitution. The statute is likely constitutional, however, because of an exception where local fees may be raised to cover the costs of implementation. The language of SB 1383 says "[t]he regulations [promulgated under SB 1383] shall comply with all of the following: (1) May require local jurisdictions to impose requirements on generators or other relevant entities within their jurisdiction and

may authorize local jurisdictions to impose penalties on generators for noncompliance..." In other words, the state may require local governments to impose specific requirements for organic waste recycling levels on generators located within their jurisdiction and may require those local governments to impose penalties on generators that fail to meet regulatory requirements.

This enforcement requirement by the state upon local governments would typically be considered an "unfunded mandate" because the California Constitution, Art. XIII B, § 6 requires the state to reimburse local governments for the costs of an increased level of service, which will certainly be the case as local jurisdictions must develop new destinations for organic waste and whole new systems for getting the waste to the correct destination. However, SB 1383 indicates that the bill is not subject to the reimbursement because under § 17556 (d) of the Government Code, the Commission on State Mandates shall not find costs to be mandated by the state if the local agency "has the authority to levy service charges... sufficient to pay for the mandated program or increased level of service." Therefore, the state expects local disposal fees to increase in order to pay for organic waste recovery and recycling.

While likely constitutionally permissible, and arguably appropriate considering disposal fees are relatively low compared to other developed economies as discussed above, this mandate will surely make the regulations politically unpopular as costs will be passed through waste generators to consumers. On the other hand, the ability to charge additional amounts for additional disposal services will also make source reduction economically attractive to generators, which is an even better intervention than recovery

or recycling, and internalizes the social and environmental costs of landfilling materials that would be better used to feed people, correcting the market failure of the current system.

The Legal Framework of Food Recovery under State Law

The state of California, through the mandates of SB 1383, has chosen to focus on recovery at the retail and food service level. The regulations promulgated under the authority of SB 1383 phase in what generators are covered by the statute: "Tier 1" generators must meet the 20% food recovery requirement by 2022, and include supermarkets; grocery stores with a total facility size equal to or greater than 7,500 square feet; food service distributors; and wholesale food markets (CalRecycle, 2019). "Tier 2" generators will be regulated starting in 2024, and include restaurants with 250 or more seats, or a total facility size equal to or greater than 5,000 square feet; hotels with an onsite food facility and 200 or more rooms; health facilities with an on-site food facility and 100 or more beds; "large" venues or events; state agencies with a cafeteria with 250 or more seats or total cafeteria facility size equal to or greater than 5,000 square feet; and local education agency facilities with an on-site food facility (CalRecycle, 2019). This means that large retailers and distributors will be responsible for creating new edible food recovery systems or strengthening existing systems, and will likely serve as models and important sources of information and infrastructure for the second wave of regulated entities.

It is important to note that as an expansive piece of legislation to reduce methane emissions, SB 1383 encourages other interventions in addition to edible food recovery,

including diversion of food waste at the consumer level. However, because the focus at the consumer level is on recycling by composting or anaerobic digestion, not recovery of edible food, it therefore falls outside of the scope of this analysis. Focusing on the retail and food service level, as well as on recovery as an intervention, provides the opportunity to analyze a more discrete universe of problems as well as more targeted solutions that will be relevant to stakeholders as they implement one particular aspect of SB 1383 in the coming years.

The fact that SB 1383 creates a partial ban on landfilling food waste does have an impact on food recovery, however, because businesses must comply with both parts of the legislation. Not being allowed to send food waste to the landfill means that businesses may choose to recover a greater portion of their potential waste because paying to recycle the waste may actually be more costly than paying a recovery organization to transport excess food to needy people. Therefore, the fact that SB 1383 requires a certain amount of food waste to be recycled rather than landfilled will likely have a positive influence on local governments' ability to meet the edible food recovery provisions of the law.

Conclusion

This chapter explored the many pressures that local governments will face when creating policies to efficiently implement food recovery programs within their jurisdictions. I examined the social and environmental factors that will influence implementation. For one, food insecurity in California is varied, and typically impacts rural counties that are close to urban areas the most because the cost of food is typically higher. This may mean that addressing hunger through food recovery will be particularly

challenging, because there may be a high demand for low-cost food without the supply available from a larger economy. It is also important to keep in mind that food recovery is one small intervention within the context of addressing hunger in the state, and may even be a counter-productive intervention if it allows governments to ignore more systemic problems of poverty. As for environmental factors, food waste is a significant contributor to greenhouse gas emissions in the state, and food recovery is a particularly efficient intervention to minimize the negative environmental impacts that food waste has on the environment. I also explored the safety concerns inherent in recovering food waste for human consumption, and noted that liability and bad press are significant concerns for potential donors, even while there are substantial state and federal laws to protect food donations from liability.

I explored the economic environment in which food donations will likely occur. I showed that because the cost of landfilling food waste is relatively low in California, it is economically attractive for potential donors to take the easier route and simply dispose of excess food. It will be important for local policy-makers to emphasize the relative economic benefits of recovery over recycling of food waste in order to maximize the amount recovered as required by state law. I also discussed the economics of food recovery, and noted that because SB 1383 expanded local responsibility without providing funding, there will need to be creative solutions developed at the local level in order to create consistent funding for recovery systems.

Finally, I discussed the political and legal environment surrounding food recovery. While there will likely be continued statewide support for food recovery as

directed by state law, local reaction to those requirements is less clear. Because the requirements are an unfunded mandate, locals will have to grapple with how to provide a different kind of service to their jurisdictions without instigating resistance from current food waste generators and their local taxpayers. The fact that recovery may be an economically advantageous alternative to food waste recycling means that governments may have an easier time encouraging the recovery of edible food than if the landfill ban of food waste provisions of SB 1383 did not exist.

In the next chapter, I will begin my discussion of potential alternatives local governments could use to meet the edible food requirements of SB 1383.

Chapter 3: Construction of Policy Alternatives

In this chapter, I use the discussion of the problem from chapter one and the relevant political, economic, and social environment factors from chapter two to inform my consideration of policy alternatives to rescuing food waste. Bardach (2012) suggests starting with a wide range of policy options and using practices that are being used in other jurisdictions before narrowing those options to a handful that seem the most promising. I begin the chapter with a brief re-examination of the causes of food waste. I then turn to the variables that influence the current practice of wasting food. Finally, I present a number of interventions that are aimed at addressing those variables.

In sum, this chapter addresses the formation of the alternatives for the CAM analysis that is the centerpiece of this thesis. These alternatives are based on an extensive review of the literature and discussions with county officials tasked with implementing food recovery in their jurisdictions, food recovery organization staff, waste management consultants, and CalRecycle staff. Below, I summarize each alternative I considered, and lay out reasons why each alternative was or was not chosen for the final CAM analysis. In addition to proactive alternatives, I will also address the option of "letting present trends continue," as Bardach suggests (p. 18). If policymakers take no action, existing food recovery networks will continue to rescue food across the state. While I will consider doing nothing as a legitimate alternative, I will also explain why I chose not to include it in my CAM analysis.

Part I: Causes of Food Waste

As discussed in chapter one, there are a multitude of reasons why so much of the food we put time and effort into creating never makes it to a willing consumer. While there are significant losses upstream at the production level and waste downstream at the consumer level, the focus of SB 1383's edible food recovery provisions are limited to the waste that occurs at the retail and food service level. There are many reasons why food may be lost or wasted at the distributor level. Even before food reaches the retailer, during transportation and storage, trimming may dispose of unattractive, but edible, portions of food; improper temperatures or delay may cause food to spoil before it reaches its destination; or inadequate training may lead to mishandling of food (Gunders, 2017). During processing, accidents in the factory may spill otherwise marketable milk, or high quality standards may remove imperfect fruits from the produce box (Lipinksy, et al., 2013).

At the retail and food service level, displays that express abundance may be oversupplied, or a restaurant may buy too many of an ingredient that is never ordered by a customer, leading to disposal of excess food at the end of the day; perishable items may have a very limited safety window, after which they may be thrown away; or ambiguous date labels may encourage stores to dispose of food that is still edible (Gunders, 2017). While not covered by the food recovery requirements of SB 1383, the end consumer may buy food that he forgets to prepare and may throw it out when it spoils, or may be persuaded by a date label to throw out food before it actually spoils (Gunders, 2017).

Diners may eat less than the preparer anticipated, or a picky eater may not finish what is on the plate, and may scrape the leftovers into the trash (Gunders, 2017).

Meeting the recovery requirements of SB 1383 will take a multi-faceted approach because there are numerous reasons why so much food is currently being wasted, and a wide variety of food waste generators with unique motivations and ways of treating food. Even though "retail and food service" is technically one category, it includes many different kinds of actors: retailers include both large grocery chains and mom-and-pop corner stores; venues include sports stadia and high-school concession stands; events include industry conventions and wedding receptions; restaurants include buffets that seat hundreds and food trucks that serve dozens but seat no one. Governmental, hospital, and school cafeterias also fall within this category. While the regulations adopted pursuant to SB 1383 limit regulation of many such producers based on the size of the facility, it is clear that many different types of institutions will need to consider the food waste that they currently produce and develop a plan to reduce it. The two tables below distinguish between Tier 1 and Tier 2 edible food generators, estimate relative amounts of recoverable food from particular categories of generator, and list special considerations that likely apply to different generators (see Tables 1 and 2).

The proportion of waste in the tables below are the range of relative amounts of waste found in a three-city study by the NRDC (Hoover, 2017). NRDC conducted analyses of Nashville, Denver, and New York City as part of a larger study that sought to chronicle each city's current food rescue capacity and its potential to increase food recovery in coming years (Hoover, 2017). Therefore, the ranges of the proportion of food

waste generated shows the range found in those three cities. There are as of yet no studies that analyze the proportion of food waste generation by sector in California, so the data below serve as a rough proxy. While the ratios in California cities are likely different from the ratios in the cities studied, it at least gives some indication of the potential recovery for the different sectors, and can serve as a guide to where to focus recovery efforts given the limited resources of local governments.

Table 1

Tier 1 Edible Food Generators

Generator Type	Example	Proportion	Considerations
Supermarket	Safeway, Raley's, etc.	10–13% (together with grocery stores)	Most food is packaged or unprepared; some prepared food in delis.
Grocery store of 7,500 ft^2 or more total space	"Mom-and-pop" grocer, but bigger than most convenience stores	10–13% (together with supermarkets)	See above.
Food service distributor	"Middle-man" between manufacturer and grocer.	8–15% (together with wholesalers; also includes manufacturing and processing)	Food is stored in warehouses or in transit.
Wholesale food market	Produce market where restaurants and other vendors are the customers.	8–15% (together with distributors; also includes manufacturing and processing)	Most food is segregated and in bulk.

Proportion data from "Estimating Quantities and Types of Food Waste at the City Level," by D. Hoover, Natural Resources Defense Council, 2017 (https://www.nrdc.org/sites/default/files/food-waste-city-level-report.pdf)

Table 2

Tier 2 Edible Food Generators

Generator Type	Example	Proportion	Considerations
Restaurant with 250 or more seats; or of 5,000 ft^2 or more total space	Casino-size restaurant	42–50% (includes restaurants of any size and caterers)	Most excess food is prepared, with a limited recovery window.
Hotel with on-site food facility and 200 or more rooms	Hyatt or other large hotels	6–9% (includes hotels of any size)	Similar to restaurants.
State agency with cafeteria of 250 or more seats; or of 5,000 ft^2 or more cafeteria space	CalPERS cafeteria	Not assessed	Similar to restaurants.
Health facility with on-site food facility and 100 or more beds	Hospitals; nursing homes	2–5%	Similar to restaurants.
Large venue	Sports arena	1–4% (together with events)	Most excess food is prepared. Large number of individual vendors.
Large event	Music festival	1–4% (together with venues)	Same.
Education facility with on-site food facility	Schools with a cafeteria; college campuses	4–7% (includes K-12 and college campuses)	Consumers/students have fewer choices/set menu. Use of "share tables" repurposes food on-site.

Proportion data from "Estimating Quantities and Types of Food Waste at the City Level," by D. Hoover, Natural Resources Defense Council, 2017 (https://www.nrdc.org/sites/default/files/food-waste-city-level-report.pdf)

The study included both edible and inedible, and therefore unrecoverable, food waste, so the results should be interpreted with caution (Hoover, 2017). However, it is a relatively safe assumption that the inedible food waste created by preparation in restaurants (peeled potatoes, carrot tops) is likely a small portion of the overall food waste. In addition, given the fact that inedible food waste was included for all categories, the relative percentages of recoverable food waste is likely similar to the published findings.

While beyond the scope of this thesis because it is not addressed by SB 1383, it is important to note that Hoover (2017) found the largest generator of edible waste in the three cities was the residential sector, accounting for 33–54% of the edible food generation in those cities. Limited to the types of generators considered by this thesis, it is striking that the largest generator in all three cities by a wide margin is restaurants, with three to five times the amount generated as the next largest generator types: retail grocers and wholesale distributors (Hoover, 2017). It is likely that the nature of the food wasted – prepared food with a limited recovery window – contributes to the amount wasted by restaurants.

Part II: Variables that Influence Food Recovery at the Food Service Level

The policy options proposed in the subsequent section are forms of government intervention that seek to alter the market forces that encourage disposal of edible food. This section outlines the major variables that influence the ability to successfully recover edible food. These variables include:

- *Infrastructure Capacity*, such as transportation and storage capacity for recovered food, and the human capital to prepare and serve the food to consumers
- *Legal and Reputational Concerns*, such as liability for unwittingly making someone sick from spoiled food that slipped through the food safety net. Even when legal liability is not a worry, a business may still be worried about its reputation
- *Economic Challenges*, such as the disincentive to put time and labor into recovering food when disposal is a cheap and easy option
- *Information Gaps*, such as lack of awareness about the importance of recovering food. It also includes the lack of coordination between food waste generators and recovery organizations.

Infrastructure Capacity

While consumer-facing businesses such as restaurants and grocery stores obviously have sufficient storage and transportation resources to run their own operations, most lack the extra space and transportation capacity to ensure that extra food isn't simply thrown away (ReFED, 2016a). Even if the food gets delivered to a food recovery organization, however, it may still remain unconsumed because those organizations may not have the capacity to store and process unpredictable deliveries of food, particularly when it is perishable (ReFED, 2016a).

While there is an excess of food in the United States as a whole, the challenge is that those in need of food are often in a different location than where the available food is. Rural households may find it easy to access one kind of fresh produce that is produced

down the road, but because populations are spread out in rural areas it may be difficult for one family to access a variety of food or for one producer to reach a large percentage of the population. Conversely, while the urban poor may be concentrated in small areas which facilitates reaching more people with less effort, the distance from food producers may make procurement channels more difficult to establish and maintain (ReFED, 2016a). Regional differences in food production also add a layer of challenge. Almost half of all fruits, vegetables, and nuts are grown in California, which means local food supplies look very different than the Midwest, which produces a greater percentage of grain and livestock (ReFED, 2016a).

Legal and Reputational Concerns

The federal government implemented the Good Samaritan Food Donation Act to protect donors and food delivery organizations from civil and criminal liability stemming from illness caused by donated food unless the organization was grossly negligent or purposeful in its wrongdoing (ReFED, 2016a). The California Good Samaritan Act (AB 1219, Eggman, Chapter 619, Statutes of 2017) expanded protections to organizations that donate directly to needy individuals in addition to food banks, and allows donation of food that is beyond the date of its shelf-life if the donor makes a good-faith assessment that the food is still fit for human consumption. The bill also requires public health officials to promote edible food recovery.

Despite these protections, many otherwise willing donors still balk at the potential backlash that could arise from food donations: retailers may be more worried about front-page news saying their food killed someone than that someone may take them to court

(ReFED, 2016a). In addition, as of the *Roadmap*'s publication, the federal law had yet to be tested in court, leaving corporate legal departments without precedent to help them ensure they are on solid legal footing when they advise their clients about donating food (ReFED, 2016a).

Economic Challenges

While federal and state tax incentives make donation somewhat more attractive for potential donors, the amount of incentive rarely covers the additional costs to the producer (ReFED, 2016a). The producer therefore is likely to take the path of least resistance and dispose of the food. Even when it costs money to dispose of waste because of the cost to dispose of food waste, it is frequently cheaper both in time and money to dispose of edible food in the trash rather than finding an alternate destination for it (ReFED, 2016a). As discussed in chapter two, this is partly attributable to tipping fees that are relatively low in the US compared to other industrialized nations, especially where land is plentiful (ReFED, 2016a). Even though California's rates are slightly higher than the US average, haulers' ability to negotiate rates make disposal of food in the landfill very affordable compared to the logistical tangle of creating and maintaining an entirely separate stream for edible food waste.

Information Gaps

Even though businesses have a built-in incentive to minimize costs by only buying the food they are able to resell and diverting food from the waste bin to minimize disposal costs, they may lack the information needed to make better decisions. Food Shift, the food rescue organization in Santa Clara county, found that nearly a third of

food businesses did not know how or where to donate surplus food (Frasz, et al., 2015). It also found that public agencies and technical assistance consultants de-emphasize food recovery compared to other less efficient interventions such as composting and anaerobic digestion (Frasz, et al., 2015). One city representative interviewed by Food Shift reported that corporate campuses track sustainability metrics in ways that prioritize compost over recovery (Frasz, et al., 2015). A consultant claimed that because rescue is labor- and resource-intensive, "it doesn't make a lot of sense to prioritize [recovery] over other diversion alternatives... the negative impact of running an extra truck route would take more energy than the positive impacts from the reduction in food waste" (Frasz, et al., 2015, p. 24).

In summary, recovering food not only includes overcoming logistical hurdles, but changes in attitudes about how serious a problem food waste is and the positive impact society can have on both the issue of hunger and the environmental impacts of food waste if more attention can be focused on addressing those barriers. Our current system lacks the physical infrastructure to store and transport food from where it exists to where it is needed, and the human capital to prepare it for consumption. Businesses that fear legal or reputational damage often shy away from donating food, or simply don't think it's worth the cost and effort to divert food from the trash. In addition, informational gaps about the benefits of recovery or a lack of prioritizing feeding humans rather than other diversion options, as well as lack of awareness about the recovery opportunities that exist, all prevent food from being recovered. In the following section, I focus on recovery interventions that address the challenges identified in this section.

Part III: Potential Solutions to Increasing Food Recovery

Based on my research, I propose four alternatives for local governments to support food recovery at the local level sufficient to meet the 20% requirements of SB 1383:

(1) Engage local public health officials in recovery outreach and education

(2) Invest in food recovery infrastructure and management

(3) Facilitate planning and coordination between donors, recovery organizations, and transporters

(4) Encourage the use of technology, such as software to match donors and recovery organizations with on-the-spot transporters for time-sensitive donations.

I also discuss below two alternatives that I considered, but ultimately declined to include in my final analysis: (5) provide tax incentives for donors, and (6) take no action.

Alternative 1: Engage local health officials in outreach and education

Local governments can leverage existing relationships between their staff and local businesses to encourage donation of edible food. Health inspectors already conduct outreach to local food retailers to educate them about food safety and to ensure that the business is following regulations. The draft regulations under the authority of SB 1383 task local governments with providing food waste generators with information about their responsibilities to recover edible food and what food recovery resources are available in the jurisdiction (CalRecycle, 2019). While the May draft removed a requirement for jurisdictions to provide information about liability protections for donors under the state Good Samaritan Act, as mentioned in chapter two, the state Act does include such a requirement for local health inspectors during routine inspections. Given the fact that

Food Shift found that 61% of food producers in Santa Clara County were concerned about such liability, this information is critical to reducing barriers to donations (Frasz, et al., 2015). Health inspectors, equipped with the dual message that food safety is an important priority as well as the public health benefits of feeding people with excess food rather than disposal, can empower generators to connect with food recovery organizations and reduce anxiety about negative consequences of donating.

Alternative 2: Invest in infrastructure and management

At the receiving end of food recovery, non-profit food banks and other distribution organizations could benefit from investment in physical infrastructure and labor to utilize available donations. This includes cold storage to keep food fresh until it is able to be prepared; refrigerated trucks to safely transport donations from the donor to the distributor; and drivers, handlers, and kitchen staff to do the work. Specific projects could map areas that lack adequate storage for the local need, or identify "hot-spots" where edible but unmarketable food is discarded, and target recovery at specific locations (ReFED, 2016a). Both CalRecycle and non-profit foundations have shown significant support for such investment in recent years.

In addition to expanded storage and labor, recovery systems can better utilize current inefficiencies in food distribution systems. Haulers that deliver food to large retailers are commonly empty on the way back to the warehouse. Innovative networks could be created that back-haul edible but non-marketable food to distribution centers that could partner with food recovery organizations. This would use existing infrastructure to recover easily gathered excess food (ReFED, 2016a). Retailers and food-

service distributors could lend idle trucks to food recovery operations (ReFED, 2016a). Food recovery organizations could link with existing social services such as health care and education to use existing infrastructure to distribute food (ReFED, 2016a).

Alternative 3: Facilitate planning and coordination

Draft regulations hold counties and the cities within them individually responsible to meet the requirements of SB 1383, so it is in those entities' interest to coordinate recovery efforts. As discussed in chapter one, Orange County has already created a public/private partnership in which the local government provides support to a coordinating organization that manages the entire recovery system, WNOC. WNOC identified several advantages of such an arrangement. By bringing all of the stakeholders together, the coalition was able to develop a plan that not only brainstormed innovative ideas and approaches to tackling food recovery, but also created a web of support for the non-profit recovery organizations (WNOC, 2017). The organization serves as a clearinghouse of information for all of the outreach programs and advocacy efforts. It serves as the owner of donor-matching software, the purchaser of equipment and the manager of the deployment of equipment amongst the coalition members. Because the local government couples its programmatic support with a tipping tax, the coalition can also invest in infrastructure to strengthen the existing system where needed; provide training and outreach; and regularly convene stakeholders (M. White, personal conversation, October 15, 2018).

If a jurisdiction facilitated a coalition of the edible food recovery stakeholders in its area, the group could identify the local contours of the problem and how best to

address them. Different organizations could take parts of the work that are best suited to their capabilities, and could minimize duplication of work or interference with the work of the other groups, ensuring that no group is over-taxed or left out. The lead organization could promote buy-in from the entire community, and could hold both donors and recovery organizations accountable to their commitments. Because the organization could serve as the face of food recovery for the region, businesses and organizations know who to approach with questions and have less confusion about how to get started. The organization could create enough "buzz" that the entire community is aware of the campaign and could build momentum to the point where the issue shifts from why a donor would participate to why a donor *isn't* participating. Now that the program is running successfully across the county, the organization has shifted to thinking on a regional level, and changed its name accordingly to "Waste Not Our Communities" to appeal to jurisdictions outside of Orange County (M. Learakos, WNOC Executive Director, personal communication, April 10, 2019). A well-organized coalition also looks attractive to public funders such as CalRecycle, which awarded grants of more than $4 million in 2017-18 to counties for its Food Waste Prevention and Rescue Grant Program, as well as private donors (CalRecycle, n.d.).

Alternative 4: Encourage the use of technology

"Donation tracking" software enables food recovery organizations to provide volunteer drivers with real-time information about available food and where it needs to be donated. While a single small donation may be cost-prohibitive for an organization to pick up, multiple small donations clumped in a small geographical area could make the

trip worth the effort (ReFED, 2016a). Transportation and volunteer schedules could also be coordinated in real-time (ReFED, 2016a). Given the Hoover's (2017) findings that restaurants account for a significant proportion of edible food that is currently landfilled, focusing on recovery from restaurants could be particularly advantageous. One example of a successful use of such technology is 412 Food Recovery, a recovery organization that began in Pittsburgh, PA and has expanded its model to Cleveland, OH and San Francisco (Karidis, 2018).

The organization partners with donors such as grocers and restaurants, who call staff when they have a donation. Staff find appropriate donees in their database, which includes traditional food banks as well as other locations where food-insecure individuals are located, such as schools and apartment complexes (Karidis, 2018). Staff make a determination about what donee is best suited for the donation: a soup kitchen could incorporate a larger amount of a single item into their next meal, while a coordinator at a housing complex could alert residents of incoming prepared meals and distribute them in a community room (M. Cronin, personal conversation, December 12, 2018). Once the connection is made, the technology sends out notifications to volunteer food runners, much like a ride-sharing app alerts potential drivers (Karidis, 2018). They can use their smartphone to accept the assignment and deliver the food within the window of time needed to ensure food safety (M. Cronin, personal conversation, December 12, 2018).

Alternative 5: Provide additional tax incentives to generators for food donations

Potential food donors may be encouraged to divert food from the trash if existing federal tax incentives were supplemented by local or state incentives. As mentioned in

chapter one, it is relatively inexpensive for food waste generators to dispose of food waste in the trash in California. However, once landfill bans go into effect for food waste under SB 1383, the relevant comparison for potential donors should be between recovery and composting or other diversion, which is significantly more expensive than landfilling. Because SB 1383 does not require all food waste to be diverted from the landfill, however, there are some limitations to using this price difference as leverage to encourage donation over alternate uses.

There are several downsides to subsidizing tax incentives to encourage donation, even if it makes donation more financially attractive than the disposal of the portion permitted under SB 1383. For one, most businesses are better motivated by ethical considerations than financial reasons: Food Shift's survey found that while 92% of food producers identified feeding the hungry as their primary incentive to donating, only 19% cited charitable tax donations (Frasz, et al., 2015). In addition, funding for new tax incentives comes from the same governments that are responsible for meeting the needs of their citizens. An additional dollar that goes toward subsidizing food donations is a dollar less that is available for other public programs. If tax breaks wouldn't have much of an impact on generators' willingness to give, but would significantly raise the cost of food recovery to local governments, this does not seem like a wise investment.

Alternative 6: Allow present trends to continue

The draft regulations currently in the formal rulemaking process under the authority of SB 1383 have a multitude of requirements to promote edible food recovery. They have planning requirements to encourage local jurisdictions, in partnership with

edible food recovery organizations, to grapple with what recovery capacity already exists and what would need to be done to close the gap between current levels of recovery and the amount required by law (CalRecycle, 2019). They have outreach provisions to require jurisdictions to develop a list of food recovery resources and to educate edible food generators about food recovery (CalRecycle, 2019). The regulations have reporting requirements to keep the state abreast of each jurisdiction's outreach and recovery efforts, as well as the amount donated by generators and received by recovery organizations (CalRecycle, 2019).

With so many requirements soon to be in place, one additional policy choice is to simply let current food recovery efforts evolve naturally in the wake of the law's more significant requirement to find alternate uses for 75% of currently-landfilled food waste. Given the economic incentives to recover rather than recycle food as discussed above, perhaps some businesses will be motivated to build or expand their own relationships with recovery organizations, with little intervention necessary from the local government. There are certainly some communities in California that have already embraced food recovery as a local initiative, and could meet the new requirements with existing programs. Those jurisdictions may be resentful of the additional requirements when they believe they have already implemented a successful program.

Other jurisdictions may not see recovery as a priority, or may be overwhelmed with other priorities, and will likely be resistant to what is essentially an unfunded mandate from the state. Because the legislature has done an end-run around the unfunded mandate prohibition by allowing local jurisdictions to raise rates in order to pay for

recovery and recycling of food waste, local jurisdictions are put in the difficult position of either the politically unpopular raising of costs to add recovery and recycling to their services, or resisting the state's requirements, which would not only lead to costly and time-consuming legal wrangling between local jurisdictions and the state, but would also continue the environmental and social wrongs that the law is aimed at correcting. This could in turn increase tensions between local and state governments in California. While existing recovery efforts will likely continue in those communities, it will be done by often financially-strained local non-profits with limited coordination between them.

Letting the regulations take effect without buy-in from local governments, therefore, will likely lead to higher rates for local services without much additional environmental or social benefits as a result. While it may be a tough pill to swallow for more independently-minded jurisdictions, it would be a better use of time and resources to implement the policy choices suggested in this thesis rather than deal with enforcement and fines from CalRecycle as a result of failing to implement sufficient recovery systems.

Conclusion

In this chapter, I discussed the causes of food waste, and the different variables at the retail level that make edible food recovery challenging, including economic forces, fear of liability, and lack of recovery infrastructure. I then turned to interventions that local governments could employ to overcome some of those challenges, including engagement of local officials to spread the word about the importance of recovery, investment in recovery infrastructure, encouragement of coordination between stakeholders, and incorporating technology to expand on-demand recovery. While

recognizing that additional economic incentives may have a positive impact on generators' willingness to donate, the tendency for most donors to give for non-economic reasons, and the cost such incentives may have on other social programs, led me to dismiss this as an alternative for the present analysis.

Before evaluating these interventions against each other in chapter five, I will first describe the criteria I will use to conduct the CAM analysis and explain why I chose each criterion. This will be the focus of the following chapter.

Chapter 4: Selection of Measurement Criteria

The previous chapter introduced the policy alternatives I will evaluate in this chapter. The alternatives are (1) engagement of local public health officials in recovery outreach and education; (2) investment in food recovery infrastructure and management; (3) facilitation of planning and coordination between donors, recovery organizations, and transporters; and (4) encouragement of the use of technology, such as software to match donors and recovery organizations with on-the-spot transporters for time-sensitive donations. The need to choose from a broad menu of policy options requires a structured process for determining which alternatives are most preferred for addressing the challenge of meeting SB 1383's recovery mandate.

As described in Bardach (2012), one commonly-employed structured process is to systematically weigh the benefits and drawbacks of each alternative according to a set of selected criteria. The criteria serve as measurement tools that give policy makers the ability to evaluate a given policy against other alternatives in its totality, but to also consider it based on a single criterion. Depending on the political environment in which the policy maker operates, this allows the policy maker to adjust the analysis according to his or her own priorities, or the priorities of his constituents.

This chapter first provides an overview of the process of developing a set of criteria. It then discusses each criterion and the relative importance I gave to each. For the purposes of this thesis, I seek to identify the policy that will strike a balance between (1) producing the greatest recovery of edible food from retail and food service generators, (2) minimizing costs to the food recovery system, and (3) minimizing the cost to local

governments who are ultimately accountable for the success of the recovery effort. Other important considerations include the quality and type of the recovered food – if the food recovered is of low nutritional value or undesirable for end-consumers, then it will likely either be consumed, but not promote the health of recipients, or be left to waste at the consumption stage.

With these goals in mind, and based on my understanding of the environmental and social problems attributable to the waste of edible food, I have chosen five criteria that I use to evaluate each of the proposed alternatives. These criteria are:

(1) Efficiency

(2) Equity

(3) Ease of Implementation

(4) Feasibility

(5) Sustainability.

Criteria Selection and Justification

This section presents definitions and justifications for each of the five selected criteria listed above. The justifications serve to help policy makers understand how each criterion can predict what potential the chosen policy alternatives have towards achieving the desired outcome. In the case of edible food recovery as mandated by SB 1383, the desired outcome is a statewide recovery for human consumption of 20% of now disposed-of edible food at the retail and food service level of the food system in California. Desirable policy outcomes in addition to the primary outcome include recovery that is cost-effective (efficient), allocates costs fairly (equitable), is relatively

simple to administer (ease of implementation), will not be overwhelmed by political resistance or legal challenges (feasible), and can be sustained over time (sustainable).

Efficiency

Efficiency usually describes how cost-effective a policy is; that is the best "bang for the buck." The bang in this case is the amount of food that is recovered and actually consumed by needy Californians. The buck is the expenditure in labor and capital to recover the food. Bardach describes efficiency as "maximizing the public interest" (2012, p. 33). An efficient policy will maximize the total benefits to society, in both social and environmental terms, while minimizing the cost of recovery. Another way to think about efficiency is to what extent a policy choice avoids disrupting the current economy. Such disruption is often inevitable, however, when the market failure that allows food waste to occur need to be corrected to protect the public interest.

Efficiency is an important consideration when evaluating a potential policy choice because it discourages adoption of rules that are overly burdensome on constituents because the government spends too much for too little outcome. On the other hand, a less efficient policy may be favorable because it is more equitable. It is important not to only focus on efficiency, because in isolation it is an incomplete indicator of a policy's overall benefits (Bardach, 2012).

Equity

A policy choice that recovers tons of food, but exacerbates existing inequities across California, is not as desirable as a policy that provides communities with the greatest need with the most assistance. The areas of the state with the most excess food

may not necessarily be the communities with the most need for recovered food, and vice versa. Therefore, even if a policy were very efficient in terms of small expenditures to move food a small distance, it would likely grow the gap between "haves" and "have-nots" in California, who may be many miles from a reliable source of recovered food. By the same token, placing the full burden to recover edible food on cash-strapped local governments and mom-and-pop food waste generators will likely make those communities worse off than if no policy was implemented, even if it means that a marginal increase in food rescue occurs.

Therefore, it is important to weigh the burden and the benefits of a particular policy choice for different stakeholders, including: local governments in rural and urban areas, as well as low- and high-income areas; business owners that need to change their current behavior as to edible food waste; food recovery and meal delivery organizations; and the consumers of recovered food.

If a particular policy raises food prices for everyone in a community, this would also not be equitable. If a policy that is intended to help needy families instead hurts local economies, this should be considered a negative outcome that may even outweigh the benefits of recovery.

Ease of Implementation

This criterion looks at the relative ease or difficulty of implementation a given policy requires. Even a policy that is efficient, fair, sustainable, and feasible may fail if it would require tremendous resources or require a complete shift in the way a given jurisdiction deals with food recovery. A policy that is expensive and complicated to

implement would not score as high as an alternative policy which may be less fair but requires fewer large-scale changes to implement. Policies that leverage existing resources by tweaking them to accommodate food recovery, rather than create a completely different system, would therefore score higher on ease of implementation.

Ease of implementation also encompasses how easy it would be to "fine tune" a policy alternative once it is implemented. The grander the scale of a policy, the more difficult it may be to change it once it is up and running. By contrast, a policy that is flexible and can account for differences between what was expected to occur after policy implementation and what actually occurs would score high on the implementation criterion.

Feasibility

Clearly, when a policy proposal is subject to political and/or social resistance, it is much less likely to even be tried once, and is even more difficult to sustain in a hostile climate. As mentioned in chapter two, waste management decisions in California are part of a highly-politicized environment that influences policy choices and dictates how much support, whether financial, via news media, or in the minds of society at large, any particular policy may get. Even a policy with certain environmental and social benefits could fail to be adopted, or if adopted, fail to be successful, in the face of strong political opposition. Therefore, a policy alternative will score high on the feasibility criteria based on the expected chance that it could gain political popularity and be supported by the entities responsible for implementing the policy.

The existing legal framework that surrounds solid waste and food safety management also plays a role in the feasibility of a given policy alternative. A policy that is too onerous on local businesses might encourage them to bring suit against CalRecycle to strike down the requirements of the regulations at the state level, or to at least upend their local jurisdiction's food recovery ordinance. This would mean not only delay and potential repeal of recovery efforts, but would be a waste of financial and human capital tied up in litigation rather than directed toward implementation of the policy.

By the same token, fear of litigation or bad press also plays a role. Even though California has instituted legal protections for donors of edible food, the "myth of liability" still persists. Frasz, et al. (2015) found that 62% of food producers surveyed remain concerned about liability for donating food, even though the federal Good Samaritan law has been in place for years. Even without worry about legal risk, potential donors may still have reasonable worries about reputational harm. Therefore, a policy that reduces the fear of litigation or damage to reputation would also score high in the feasibility criterion.

Sustainability

A sustainable policy is one that has a beneficial impact beyond the scope of its immediate intervention. The question of sustainability specifically asks whether communities would continue to benefit from a policy once the policy has ended. This is a particularly important criterion when the policy at issue is intended to correct for a market failure within the existing system, as is the case with edible food that goes into landfill rather than feeds a hungry person.

Sustainability is an important factor to consider in this analysis because the longer a food recovery system can consistently deliver results after formal governmental intervention, the greater the long-term environmental and social benefits will accrue. In the near-future world where humans must vastly reduce output of greenhouse gases in order to slow the effects of climate change, many of our behaviors – the way we heat and cool our homes, the way we travel, and the way we purchase and consume resources, including food, must change. If a given policy can engrain behavior changes that are relatively simple to sustain, then the policy should be deemed a successful one.

Quantifiable Measuring and Weighting

The next step in making a policy recommendation is to decide how to weigh each of the criteria. The analyst needs to ask whether each of the criteria should be given equal weight, or whether some criteria are more critical to the success of the intervention, in which case that criterion merits a greater weight when evaluating the policy alternatives as a whole.

Obviously, assigning weight to a given criterion relative to all the other possible criteria is a subjective task, and reflects the biases and the limited knowledge of the analyst. At the same time, assigning equal weight to all criteria implies that each criterion is of equal importance, which is not necessarily a reasonable assumption. Therefore, a reasonable way forward is to assign each criterion a different weight based on articulated reasons why that criterion merits greater importance. This allows a later analyst or policy maker to reconsider the assumptions made by the current analyst, as well as to take into consideration factors that are not obvious at present, but may later become clear as

jurisdictions experiment with interventions and outcomes shape our understanding of policy alternatives.

I will use a 100 point scale to evaluate each alternative, with each criterion assigned the following relative weights:

Table 3

Measurement Criteria and Weighting

Criteria	Weight	Multiplier
Efficiency	30	6
Equity	25	5
Ease of Implementation	20	4
Feasibility	15	3
Sustainability	10	2
Total	**100**	

By assigning each criterion a multiplier that corresponds to the relative weight of each criterion, this permits the use of a simple 100-point scale for reporting an alternative's overall score. In other words, if an alternative thoroughly meets the requirements of all criteria, it will receive a 100. The scoring methodology will be further explained in chapter five.

Efficiency

As shown in Table 3 above, I assigned the greatest weight to efficiency, with 30 of the available 100 points. Efficiency is a critical component of an effective policy because spending the least amount to get the most positive outcomes not only makes good sense in the abstract, but is essential to stemming criticism by those burdened with

policy implementation. In a democratic system that is ideally responsive to criticism from voters, an inefficient policy, which takes scarce resources that could be spent on other services for little tangible benefit to the public, opens up policy makers to criticism from their constituency and possible removal at the next election cycle. It is very easy for an individual or group to point to expenditures disclosed in a public budget that go toward food recovery, and if the government cannot point to commensurate positive outcomes from those expenditures, political resistance will likely follow. Therefore, an efficient use of tax dollars, where governments can point to tangible outcomes for each public dollar spent, merits the highest weight compared to all the criteria considered.

Equity

I assigned the second-most weight to the equity, or expected "fairness" of the policy alternative. This received a weight of 25 of the available 100 points, which is 5 points higher than if all criteria were weighted equally. This criterion is important because even if a policy outcome delivers the desired amount of food recovery at a reasonable cost, it matters who bears those costs. If the cost of food recovery falls fully on charitable recovery or food delivery organizations, which already struggle for resources, then they may choose to shutter their doors rather than be placed in an unsustainable position. By the same token, even if it would be efficient to place implementation burdens on for-profit businesses, policy alternatives cannot be so burdensome that they encourage evasive behavior – for instance, if a food generator cannot meet the burdens of the policy, it could encourage "illegal dumping" of edible food or "cooking the books" to appear that it is meeting its recovery requirements. This

would not only subvert the goals of the policy, but would also likely result in enforcement action by the local government and litigation, and ultimately raise costs for consumers and hamper goodwill between food generators and local government.

By the same token, equity considers the different outcomes for different communities across the state. If a high-income, urban jurisdiction is able to meet its recovery requirements easily under a given policy, but a low-income, rural jurisdiction would find the same policy alternative onerous and inefficient, then it is important to consider that aspect of the policy. As is true of all the criteria, an analysis of equity informs an analysis of other aspects of a policy choice: the more the public sees a policy as inequitable and a burden on some while benefitting others, the less feasible and sustainable it will likely be.

Ease of Implementation

The next criteria I weighted is ease of implementation. I gave it 20 of the available 100 points, so it is considered as important as if all criteria were weighted equally. Much like feasibility, this criteria was given less weight in order to give more weight to efficiency and equity. However, it is still the third highest-weighted criterion because even if an alternative is both efficient in that it gives a lot of "bang" for the "buck," and effective in that it enables tremendous amounts of recovery, the intervention is worth less than an alternative if it is so difficult to implement that it doesn't actually lead to recovery. For instance, if the current workforce lacks the training to properly handle food to keep it from spoiling, or the system lacks adequate infrastructure to handle

a sudden influx of increased recovered food, then it wouldn't matter that the food was recovered efficiently.

Feasibility

A feasible alternative is one that will likely not face significant political or legal resistance to implementation. Regardless of how beneficial a policy alternative may be in the abstract, if there is sufficient political resistance, or a successful lawsuit challenging its authority, then the effort to implement the policy is likely futile. Fear by potential donors that assisting with a policy will invite litigation is also an important consideration, because if donors refuse to donate, the policy simply will not work.

I assigned feasibility a weight of 15 of the available 100 points. While still an important consideration, I gave it less weight than efficiency, equity, and ease of implementation because if a policy alternative is efficient, equitable, and less than onerous to implement, then it is likely that resistance to the policy will not be as high. Shaping a policy with other criteria in mind will likely create a policy that scores high on feasibility as well, but feasibility should still be considered in the grand scheme of the analysis, in case there are considerations that are distinct that could torpedo an otherwise palatable alternative.

Sustainability

The sustainability of a given policy alternative is how well the positive policy outcomes of an alternative would likely persist, even if the policy were no longer required. In other words, once the policy was implemented, would it change the market for edible food recovery in a way that would continue even without further intervention

from local government? I gave this criterion the least weight in my analysis at 10 of 100 points. If all the criteria were given equal weight, sustainability would receive substantially more consideration than it does in this analysis. While not as critical to the success of a policy as that of efficiency and equity, the ability of a policy to continue to have positive effects is still worth consideration. If grant funding from CalRecycle dried up, or local stakeholders grew tired of coordinating recovery, and consequently recovery efforts ceased, then we would be back to square one. In fact, this could likely be worse than doing nothing, because it is likely that those in need that benefit from donated food would suffer if such food were suddenly not available. The dissolution of existing food recovery systems would also likely create pessimism and resistance, even in those that supported the system while it was functioning.

Conclusion

This chapter laid out the criteria that I will use in the following chapter to analyze the policy alternatives laid out in chapter three. The criteria I will use to analyze the alternatives are efficiency, equity, ease of implementation, feasibility, and sustainability. After describing each criteria, this chapter assigned relative weights to each criterion, with justification for the reasons why each criterion earned its relative weight.

In the chapter that follows, I will describe the methodology for how I will evaluate each policy alternative against each criterion, then conduct a quantitative analysis that informs my ultimate policy recommendation, which I will turn to in chapter six.

Chapter 5: Results of Analysis

This chapter presents the core analysis of this thesis. It takes the groundwork laid in chapters three and four and analyzes how well each alternative satisfies each criterion in a systematic way in order to answer the fundamental question presented by this project: namely, how can local governments across California best encourage edible food recovery in their jurisdiction? This analysis will help policymakers understand which option, based on the menu of alternatives considered, represents the "best" choice in redirecting edible food from the landfill to willing consumers.

In this chapter, I begin with an analysis of each alternative introduced in chapter three that discusses tradeoffs and benefits of the alternative based on each of the criteria introduced in chapter four. I then present a "results matrix" that shows the quantitative scores for the alternative according to each criteria. After repeating the process for the remaining alternatives, I summarize the universe of alternatives chosen for this thesis in a comprehensive matrix that shows the results for all four alternatives in one comparative chart. The alternatives that score the highest in comparison to the other alternatives, then, are the alternatives I will discuss as the preferred policy alternative in chapter six.

Bardach (2012) notes that this is the most difficult step in his eight-step system of policy analysis. He opines that even veteran policy analysts do not usually do it well, if they do it at all (2012). He believes that this step is challenging because the analyst is asked to make predictions about the future, which is always uncertain; it is difficult to overcome one's tendency to be optimistic in favor of being realistic; and it is human

nature to assume full confidence in an alternative when it may only be slightly more likely than not to be a sound choice (2012).

One practice Bardach encourages to overcome these biases is to "Construct an Outcomes Matrix" (p. 58). By making an array of policy alternatives along one axis, and evaluative criteria along the other, the analyst can consider how different alternatives compare to one another (2012). This prepares him to confront the trade-offs of any chosen path (2012). The matrices presented in this analysis are a somewhat modified version of Bardach's example matrix, in that each alternative is dealt with individually, then all alternatives are compiled in a final matrix.

Methodology

The matrices in this chapter present the probable outcomes for each policy alternative in the form of a numeric rating on a predetermined scale. To make these judgments, I relied on background research, interviews with professionals in the field of food recovery and waste management, and materials from the Master's program in Public Policy and Administration that inform my understanding of proper techniques in effective policy analysis.

I will use a rating scale of 1 to 5 to categorize how each alternative rates on a particular criterion. The ratings will have the following meanings:

Table 4

Alternatives Rating Scale

1	The alternative does not satisfy the criterion at all.
2	The alternative mostly does not satisfy the criterion.
3	The alternative moderately satisfies the criterion.
4	The alternative mostly satisfies the criterion.
5	The alternative completely satisfies the criterion.

After measuring each alternative by each criterion, I will multiply the scores by the relative weights assigned in chapter four. Specifically, I will multiply the scores for efficiency by 6, equity by 5, ease of implementation by 4, feasibility by 3, and sustainability by 2. As mentioned in chapter four, use of the multiplier factor creates a familiar 100 point scale to compare the relative scores of the considered alternatives. For example, an alternative that does not meet the efficiency criterion at all would only score 6 (1 point x 6 multiplier) for that criterion, but an alternative that satisfies that criterion completely would score 30 (5 points x 6 multiplier). If an alternative did not meet any criteria at all, the lowest score it could receive would be 20. This is calculated as follows: (1 point x 6 multiplier for efficiency) + (1 point x 5 multiplier for equity) + (1 point x 4 multiplier for implementation) + (1 point x 3 multiplier for feasibility) + (1 point x 2 multiplier for sustainability). Simplified, the equation is 6 + 5 + 4 + 3 + 2 + 1, which equals 20. A perfect score would be 30 + 25 + 20 + 15 + 10, which equals 100. The scale is therefore from 20 to 100.

It is important to keep in mind that the absolute score is not as important as each score's relation to the scores of other alternatives; that is, a "C" score of 75 may actually be a useful intervention, even if its score would be considered average in an academic setting (or failing in a Master's program), if compared to the other alternatives it scores well. In addition, if two alternatives score about the same overall, the policy maker may want to look beyond the overall score to understand how the alternative scores on a particular criterion given the particular political environment in which she has to make her decision.

Alternative #1: Engage Local Public Health Officials

Probable Outcomes

County Health Inspectors are already required to make contact with businesses that store, prepare, and sell food, so it is likely wise to leverage their existing relationships and familiarity with those businesses to raise awareness about the requirements of SB 1383 to avoid disposing of at least 20% of the edible food that presently gets tossed in the trash. However, this additional layer of responsibility is outside the core focus of the traditional role of a health food inspector, which is typically to enforce local food safety ordinances to prevent the business from making a customer sick. The message of encouragement to keep food around in order to donate it when it would typically be thrown away may seem incongruous when a business is also being reminded to handle food with the utmost care and to be constantly wary of contamination or temperature changes.

The only requirement in state law as presently written is under the state Good Samaritan Act, which says that retail food facilities cannot be held liable if their food makes someone sick unless they were grossly negligent or intentional in preparing or handling the food. While the Act does require health inspectors to "promote the recovery of food fit for human consumption during... normal, routine inspections," and "promotion shall include, but not be limited to [materials] that inform retail food facility operators about the protections from civil and criminal liability when donating food," there are no other specific mandates about what information a health inspector may share with the business that may promote recovery (Cal. Health & Safety Code § 114435). It is a far cry between "you will likely not get sued for donating" to "these are simple and effective ways to donate." Without a clear path forward, many businesses may rightly feel overwhelmed by being required to donate food but not knowing how best to do so.

On the other hand, it appears that at least some strategies for harmonizing the dual message of safety and recovery are being discussed between public health organizations and climate change scientists. A joint publication entitled "Safe Surplus Donation Toolkit: Guidance for Food Facilities" was co-written by groups of public health officials across the state and the climate science division of the Public Health Institute, a California-based research non-profit (Public Health Alliance of Southern California, California Conference of the Directors of Environmental Health [CCDEH], and Center for Climate Change and Health, 2018). The Toolkit was created for "Environmental Health Departments across California to educate food facilities about safe surplus food donation, including information on liability protections, state mandates, and safe surplus

donation practices" (Public Health Alliance, et al., 2018, p. 1). I use "public health" and "environmental health" interchangeably, because both terms encompass addressing the ways in which the natural and man-made environment impact individual and community health. It is worth noting, however, that "environmental health" is actually a subset of "public health."

The toolkit is a "one stop shop" for local environmental health officers to educate consumer-level food distributors about the basics of the problem of food waste and how to plan for and implement a food recovery system for their business. It introduces the recovery pyramid, touches on state law requirements to reduce organic waste with web links for further information, explains why edible donations are an effective way to meet organic recycling requirements, and why donating has a positive effect on the beneficiaries as well as for the business itself in the form of tax incentives (Public Health Alliance, et al., 2018). It then discusses the protections the law provides to good-faith donors, and what standards the organization needs to meet to ensure its protection, along with assurance that selling products after the "sell by" date has passed is not grounds for liability except for a few products (Public Health Alliance, et al., 2018).

The remainder of the toolkit provides advice on starting a food donation program, complete with forms that can be used by local environmental health inspectors to help food distributors implement a recovery system (Public Health Alliance, et al., 2018). The toolkit breaks the process into four steps: establish a food waste baseline amount; develop a partnership with a recovery organization; prepare a food safety plan; and create a plan for inedible food, such as animal feed or compost (Public Health Alliance, et al., 2018). It

provides specific information on temperature control to keep food safe, and offers separate checklists for grocers and restaurants to prevent waste and share ideas with fellow businesses (Public Health Alliance, et al., 2018). It provides forms to establish donation agreements between producers and recovery organizations, sample labels to inform donees of food handling and reheating requirements, and shipping forms to accompany donated food (Public Health Alliance, et al., 2018). The toolkit also offers advice for specific types of donors: it has a list of suggestions for rural communities, as well as schools that may be interested in implementing "share tables," where students place uneaten wholesome food from their own tray for consumption by other students, as well as making donations of excess food (Public Health Alliance, et al., 2018).

The existence of the toolkit indicates that the idea of food recovery is at least on the radar of state public health officials. In addition, because some of the materials in the toolkit were based on tools that the Los Angeles County Food Redistribution Initiative (a division of the County Department of Public Health) created, it is clear that at least some local governments have taken the initiative to acknowledge the gap between the problems of food waste and hunger, and link them together through the tool of food recovery (Los Angeles County Food Redistribution Initiative, n.d.).

In addition to participating in production of the toolkit, a representative from CCDEH presented at a recent CalRecycle-organized public hearing regarding food recovery (Malan, 2017). In the presentation, CCDEH gave an overview of food waste and food insecurity statistics; acknowledged food waste's contribution to methane emissions; highlighted legislation that requires businesses to avoid landfilling food waste and

promotes edible food recovery; used ReFed's report to explain the three tiers of food waste interventions; identified the main obstacles to recovery; noted the importance of collaboration between various stakeholders to address the problem; and indicated that environmental health professionals are "uniquely positioned" to address barriers to recovery (Malan, 2017). CCDEH then laid out the three prongs of its initiative:

1) Identify best practices and existing barriers to safe food distribution

2) Provide trainings and materials for CA EH regulators

3) Promote adoption of policies and procedures

(Malan, 2017, p. 16). This makes clear that public health officials understand the scope of the problem; the role that environmental health departments can play in addressing the problem; their unique position to have an outsized impact; and that a plan is already in development.

Assuming that the statewide leadership of public health officials is accurately represented by the thinking behind the toolkit and the presentation, it is likely that public health inspectors will receive ample training in how to best encourage food recovery when they are in the field interacting with local businesses. As SB 1383's requirements are enacted over the coming years, local food waste generators will be eager for guidance on how to meet its mandates, so with proper training, public health inspectors will be able to provide the tools those businesses will need to begin the process of donating food.

As discussed in chapter two, however, most aspects of public health enforcement are governed by local policy. Without adequate incentive or mandate from the state government, local jurisdictions could justify inaction based upon the cost of

implementation or upon political resistance. A significant measure of unpredictability remains for this intervention. With these considerations in mind, I now turn to how involvement of public health officials in edible food recovery fares according to the criteria.

Efficiency

Tasking public health officials with providing outreach for food recovery to food waste generators would be efficient because it simply adds a layer of service to the services those officials are already providing to the public. The public health department has already spent time delegating local businesses to various inspectors, the inspectors have already prepared to visit the facilities, and the vehicles and fuel to get the inspector to the generator is already budgeted. The main cost difference is two-fold.

First, the department must ensure that its staff are capable of adapting to a new way of interacting with its regulated entities. This may require evaluation of current staff to understand whether they are capable and willing to convey a message that is more nuanced than the inspector is used to. If the inspector is willing, but finds it difficult to adapt, additional training is likely in order. If the inspector is unable to adapt, this may require the department to hire a replacement, with additional qualifications required of new candidates. All of these costs will increase the cost of doing business for the department, but it is likely that those costs will not be on-going once appropriately-skilled staff are on board.

Second, all staff will require training on implementing a new way of doing business. Again, there will be one-time training costs, but there will likely be on-going

costs as well. Inspectors will initially need to spend significant time to explain to businesses the additional focus of the department on food recovery. That time will likely include explaining many of the concepts included in the Toolkit. Those discussions would include explaining the regulatory requirements and the economic advantages of using food recovery to meet them; how the law protects them from liability when they donate food, and how to avoid the types of behavior that could open them to liability. They would also include explaining the nuts and bolts of establishing a food recovery system, including connecting with recovery organizations; keeping food safe prior to donation; and tracking donated food to show its impact on the food waste generated by the business.

This intervention would not require new physical infrastructure, but would instead only require a shift in the way that public health departments interact with their regulated entities. Coupled with the fact that those new interactions may in fact allow businesses to see public health inspectors in a more positive light as an ally rather than an enforcer, this intervention has the potential to improve relationships and make the inspectors' job more efficient overall. On the other hand, it expands inspectors' duties and complicates their relationships with regulated entities. This may be challenging for some inspectors, as discussed above. Another limitation of this intervention is that it only deals with the supply side of recovery and does nothing to build the infrastructure necessary to get the recovered food to an end-user. Therefore, regardless of how simple it would be to implement this intervention, it means very little if it has no impact on the amount of food

recovered. Because of these limitations, this intervention falls short of being a perfectly efficient solution.

Score: 3

Equity

Because all jurisdictions require health inspections of their businesses, this intervention could be seen as equitable. Assuming that a given department buys in to the belief that public health inspectors are an appropriate source of information about food recovery, it is likely that information and preparation for the coming requirements will happen equitably across the state. As has been mentioned at several points, however, California is an immense and diverse state with varying economic resources and political sensibilities. There are likely communities that care deeply about food waste, local hunger, or both, but the local health department may struggle already to provide an adequate level of service, and adding another layer of responsibility may seem like an insurmountable climb. On the other hand, there may be affluent communities that are indifferent, if not hostile to the needy, and may be resistant to their local tax dollars supporting promotion of food recovery. If someone has the attitude that their community is already a magnet for the homeless or other "undesirable" residents, then making life easier for those folks to get a decent meal may seem more than just money wasted, it may seem like active encouragement of the needy to overpopulate the community.

For either of these two types of communities, there may be both economic and political resistance that contribute to reluctance to spending public dollars towards expanding the scope of the public health department to promote food recovery. However,

the fact that a county such as Orange County, which is by most measures a relatively conservative county, is actually a leader in food recovery initiatives hints that the concept of feeding the hungry with food that would otherwise be wasted may not be easily categorized as a liberal or a conservative policy. The fact that rural and other less well-to-do counties already have the infrastructure to spread the message, and will only have to retrain their staff as will urban or more affluent counties, also tends to show this would be an equitable intervention.

Score: 4

Implementation

Public health officials at the state and regional level clearly see the connection between the environmental and social problems created by food waste and that edible food recovery is an important tool to address those problems, as evidenced by their production of the Toolkit and the presentation by CCDEH to CalRecycle. They are therefore well on their way to making food recovery a significant part of their message to local food waste generators. If local governments work with their environmental health departments to make sure that food recovery is a priority, the work done by the regional and statewide public health organizations will likely make implementation of such education and outreach relatively straightforward.

As discussed above, this alternative requires little or no investment in physical infrastructure; it mainly requires additional training for health inspectors. It also does not require additional travel or logistics by health departments. Promotion of food recovery is an “add-on” to the visits health inspectors are already required to do as part of their

regulation of food distributors. At least initially, the intervention will likely require more time spent at each facility, and perhaps more frequent visits to initially institute a recovery program, so there will likely be additional costs, at least for a time. This intervention does have the flexibility to scale up or down depending on the circumstances, which means that the health department can make adjustments as budget and time constraints allow. For example, WNOC developed relationships with prominent and large generators such as Disney. This had the effect of raising public awareness about the initiative and as news spread, the organization built on existing relationships to develop others across the region. This flexibility means that health departments can target a few promising donors, try different things, get feedback, and expand the program gradually. The modest additional costs and the ability to scale as appropriate make this a relatively easy intervention to implement.

Score: 5

Feasibility

There will likely not be much political resistance or many legal challenges to thwart the efforts of public health officials to promote edible food recovery to their regulated businesses. This intervention is best characterized as educational or outreach, rather than an onerous mandate. Businesses are likely bracing for the impact that SB 1383's mandate will have on their operations, so are probably eager to understand their rights and obligations under state law, as well as how to meet those obligations. Because businesses are eager for help in meeting the requirements, they will likely welcome information from health inspectors rather than be resistant to it.

However, if the information is communicated poorly, or the inspector is seen more as an enforcer than an educator, some businesses may be less receptive to the information, and may even be hostile to any changes they may need to make to their operations. Particularly when profit margins are narrow, businesses may be resistant to adding another layer of training and maintenance of their staff to meet the food recovery requirements. These initial few years before penalties kick in are therefore critical to building relationships and developing systems so that health inspectors can be supporters, rather than enforcers, to avoid resistance from businesses and their allies in local government.

Score: 4

Sustainability

If local health departments tapered off their efforts to promote edible food recovery after assisting local businesses to establish systems to do so, it is likely that many businesses would still continue to recover food even in the absence of intervention. Once a system is established, and food recovery is the norm in a given operation, it is likely that if all else is held constant, that recovery will simply be a part of the ongoing operation. In addition, once the penalty phase of SB 1383 begins, health inspectors can play their enforcer role to fine businesses for failure to promote recovery, which gives businesses an economic incentive to maintain their system.

However, if personnel changes mean that there is a gap in institutional knowledge, extra work such as preserving food for recovery could fall by the wayside. In addition, if money becomes tight for the business, it may be difficult for the owner to

justify spending the staff time tracking and donating food when the business is struggling to keep the doors open. New businesses may also not prioritize recovery, particularly if the operator is unfamiliar with California law.

Score: 4

Table 5

Alternative #1 Outcomes Matrix

	Efficiency	Equity	Implementation	Feasibility	Sustainability	TOTAL
Raw Score	3	4	5	4	4	20
Multiplier	6	5	4	3	2	
Weighted Score	**18**	**20**	**20**	**12**	**8**	**78**

Alternative # 2: Invest in Food Recovery Infrastructure and Management

Probable Outcomes

As discussed in chapter three, food recovery infrastructure and management includes all of the equipment and labor that is needed to keep food safe and transported from the place of donation all the way to its end consumption. This could include several stops. The food may begin at a grocery store; be back-hauled to a distribution center; be transported to a food bank; be shipped to a food distributor; be divided into smaller quantities and combined with other foods to create a consumer-ready "basket;" and ultimately be delivered or otherwise distributed to the end consumer. If the food is perishable, proper temperature must be maintained along the chain to minimize spoilage. When handled, staff or volunteers must follow proper handling procedures. Because of

the careful handling involved along the chain, ReFED estimates that donation storage and handling will create 2,000 jobs if recovery is implemented nationwide (2016a).

While it is difficult enough for handlers to prevent spoilage of whole foods such as fruit and vegetables from a grocer, it is even more critical for rescuers of prepared food, such as unsold hot food from a restaurant or venue to maintain a proper temperature. Hot food must remain hot, or else becomes susceptible to bacteria. If the food is unable to be served within a brief window of time, it must be refrigerated, if not frozen, to preserve its safety. In other words, food recovery requires a well-coordinated system that has little room for error, or else all the effort in transporting or storing food is wasted. One broken link in the chain can upset an otherwise seamless system.

Feeding America, the nation's largest network of Food Banks, has at its disposal 14 million square feet of warehouse space, 800,000 square feet of freezer space, 700,000 square feet of cooler space, as well as 1,700 trailers plus additional trailers from outside trucking partners (Food Waste Reduction Alliance, 2015). These resources are distributed throughout the country, however, so it is impossible to say with certainty how much more infrastructure will be required for any given community as rescue efforts are geared up in the coming years.

The time- and temperature-sensitive food recovery system is also challenged by limitations in human capital. Less than half of food distribution agencies have paid staff; those that do have a median of five full-time equivalent staff, or about 200 hours per week of paid work (Weinfield, et al., 2014, p. 54). However, because food distribution agencies also reported providing diverse services, that number may be higher than the

time reported (Weinfield, et al., 2014). Therefore, many food distribution programs rely on a large volunteer workforce to be able to serve their clients (Weinfield, et al., 2014). Food distribution programs reported the median amount of volunteer time to run their programs to be about 60 hours each month (Weinfield, et al., 2014).

The Natural Resources Defense Council attempted to quantify the increased infrastructure and labor costs required to make a significant impact on hunger in Denver, Colorado (Berkenkamp & Phillips, 2017). Because the authors assumed that volunteer labor is not unlimited, they factored in labor costs at the state minimum wage of $9.30 per hour, which is scheduled to rise to $12 per hour by 2020. With the increase of the minimum wage in California scheduled to increase to $12 or $13 per hour, depending on the size of the employer, by 2020, one can assume that the Colorado analysis will be consistent with a similar analysis in California. The analysis was conservative in its estimation of investment in transportation and cold storage by focusing on wholesale and grocery sectors, because restaurants may require greater logistics and cold-storage space (Berkenkamp & Phillips, 2017). The authors also acknowledged that while some organizations may be able to handle additional food with existing resources, those that are already functioning at capacity may need additional investment to maintain operational efficiency (Berkenkamp & Phillips, 2017).

Under what the authors characterize as an “ambitious scenario,” increased food rescue could bridge about 10% of the city’s food insecurity gap, or in other words, could rescue about 901 more tons of food per year. (Berkenkamp & Phillips, 2017, p. 28). This is equivalent to 1.5 million additional meals. (Berkenkamp & Phillips, 2017). In order to

do this, NRDC estimated that Denver would need about $2 million in ongoing labor and facility costs, along with $213,000 for one-time capital expenditures for cold storage and vehicles (Berkenkamp & Phillips, 2017). This translates to about $1.10 of additional expenditures per pound of rescued food (Berkenkamp & Phillips, 2017).

It is important to note that NRDC's analysis of Denver was an isolated case-study, so its findings cannot necessarily be attributed to California. Denver is a city with a population of 732,000 in a mostly rural state, while California has several concentrated areas of population, namely the Los Angeles, San Francisco Bay, and San Diego areas, with several other densely-populated urban centers along the central valley. While it is likely obvious that per-pound calculations cannot be generalized to all communities, the NRDC's work does give some perspective on the types of investments local governments will likely need to make and how much investment will be needed to fill their particular community's gaps in infrastructure. Because each jurisdiction will be required under the regulations to identify its capacity in regards to food recovery, they should use that opportunity to conduct a similar analysis for their own area to better understand where investment is needed and to take steps toward meeting those needs.

As mentioned previously, one source for investment in such infrastructure is through CalRecycle's competitive grant process that has awarded millions already to fund innovative food rescue programs. While the amount available from that program is woefully inadequate to meet all the infrastructure needs of the state, it is possible that more funding will become available from multiple sources as food recovery becomes the norm.

Efficiency

A policy that creates the necessary infrastructure to effectively rescue food would almost certainly be a worthwhile investment. However, the amount of investment needed to purchase storage space and vehicles, as well as on-going maintenance and labor costs, will be substantial. This may mean that a given community may not find such investments to be as efficient as other interventions. Compared to tasking health inspectors with educating businesses about the law, for example, making capital investments in refrigerated trucks and buildings and paying additional food rescuers because of a shortage of volunteers is enormously expensive. The hard truth remains, however, that regardless of how well informed the populace is about food recovery, if individual businesses and food distribution organizations do not have the infrastructure to get the food from the point of potential disposal to the point of ultimate consumption, then no amount of education will actually resolve the problem.

Score: 3

Equity

Even though statewide funding for infrastructure projects can potentially level the playing field between rich and poor; urban and rural communities, the limited amount of funding, and the competitive nature of the funding tend to favor the wealthier and more innovative urban areas that have the capacity to take advantage of the funding opportunities as they arise. Such communities also have a much larger pool of private philanthropists and corporate wealth to invest in innovative ideas.

In the absence of outside funding, businesses that must avoid disposing of their organic waste may need to increase their own costs to establish a recovery system. Consequently, those costs will likely be passed on to consumers. Poor communities already struggle to make ends meet, and rising costs for businesses may have the perverse effect of making even more of the population food insecure.

Score: 2

Implementation

Investment in infrastructure is mixed in terms of implementation. On the one hand, if funding is available, then the food storage and transportation industry could easily modify its existing practices to accommodate greater food rescue. There is no shortage of expertise in maximizing efficiency in the food distribution industry, and if a local government committed resources to mapping out where food waste is generated and where the population is that could benefit from that food, investing in storage and transportation capacity would likely result in significant increases in the amount able to be recovered.

On the other hand, such investments are likely to be significant and on-going. There may be complications in acquiring land for storage in densely-populated areas, or extensive travel distances between donors and recipients in rural areas that make the infrastructure difficult to construct, or expensive to use. A jurisdiction may not be willing to risk a large investment when other links in the chain, such as sufficient volunteer capacity, are unknown. If a city must rely on paid workers rather than volunteers, their food rescue efforts may be significantly more expense than originally anticipated, and

could therefore upend the system if the voters determine it is too expensive for the results achieved. In addition, a jurisdiction also needs to consider recruitment and training costs, regardless of whether the labor is paid or volunteer. The nature of the growing season is also a consideration. There may be more seasonal opportunities available when more fresh produce is plentiful. A well-implemented system could factor in the availability of seasonal workers and make recovery a value-added process to the existing harvesting and packing season. Assuming there is significant overlap between individuals with a need for donated food and unemployment, the system could even engage the ultimate recipients of recovered food in its recovery, which would not only increase employment but could have the additional benefit of empowering recipients to be part of the solution. While expanded infrastructure to transport, store, and prepare food is critical to creating a successful food recovery system, the expense and logistical challenges in doing so mean that this alternative would only moderately satisfy the implementation criterion.

Score: 3

Feasibility

Because this intervention requires commitment of funding, there will likely be the potential for political or legal resistance. Voters may not approve of large allocations of their local budget for infrastructure if they are not convinced that it is necessary. A municipality must also be cautious about changing the culture surrounding food recovery from a charity to an industry. If the same organizations that support existing food rescue are disenfranchised in favor of larger-scale, more “efficient” models of recovery, and the culture shifts from a volunteer to a paid workforce, there also may be backlash from the

existing volunteer community. Social scientists could have a significant role to play in testing these assumptions. A city could create a pilot project with different balances of paid and volunteer labor with a corresponding study of the attitudes of both paid and volunteer participants. At one end of the spectrum, volunteers could be actively hostile to someone being paid to do work the volunteer does "out of the kindness of their heart." On the other end, volunteers may be delighted that there are others who can share the load and expand the system's capacity to recover food for the needy.

Score: 3

Sustainability

Some infrastructure investments will likely be one-time investments, and therefore would remain valuable assets even if support were later removed. However, as discussed, there are many aspects of this intervention that require on-going support: fuel for vehicles, electricity for cold storage, and pay for workers. If, however, present investments can instill a culture of food recovery that persists even after subsidies are tapered off, this intervention would significantly contribute to on-going recovery efforts.

Score: 3

Table 6

Alternative #2 Outcomes Matrix

	Efficiency	**Equity**	**Implementation**	**Feasibility**	**Sustainability**	**TOTAL**
Raw Score	3	2	3	3	3	14
Multiplier	6	5	4	3	2	
Weighted Score	**18**	**10**	**12**	**9**	**6**	**55**

Alternative # 3: Facilitate Coordination between Stakeholders

Probable Outcomes

Attempting to establish a food rescue program in a vacuum is a daunting, if not disheartening, proposition for both food generators and distributors at all links in the chain. Even if donors are willing to put in the extra effort to find willing donees, there is no guarantee that the donee can consistently use what the donor has to offer. Likewise, resource-strapped rescue and distribution organizations may want to accept any donation that they can, but may not be able to find suitable consumers during the food's limited lifespan. Coordination between the organizations that have food to donate, those that can collect the food from generators, those that can get the food to people in need, those that must keep the food wholesome until donation, and the government entity that is responsible for ensuring that safety and recovery requirements are met is therefore critical to what is necessarily a complex system with many players.

Fortunately, jurisdictions have several models to turn to within California for guidance and inspiration on how to bring stakeholders together to coordinate food recovery at the local level. Orange County's WNOC has a public-private partnership which is comprised of public health officials; representatives from the County Board of Supervisors; large-scale food generators such as CostCo; restaurants, schools, and hospitals; several local food banks; on-demand delivery professionals (in the form of volunteer taxi drivers); more than 400 distributors, including food pantries, soup kitchens, churches, charities, and community organizations; and a commercial kitchen specifically designed to repurpose and repackage food for donation (WNOC, 2016). WNOC noted

that “by sharing the onus, and more importantly the resources, among a variety of members, we are able to implement real, lasting change that turns food recovery into a daily operational practice for our members” (WNOC, 2017, p. 1). Orange County is not the only California model to follow. Both Santa Clara and San Francisco Counties also have well-established and successful food rescue programs that other jurisdictions can look to for inspiration and information; and the more that counties embrace the idea of food recovery, the more they can learn from each other as they gain experience to share.

An effective coalition can bring all the component parts of the food recovery position together to: identify the scope of the food waste problem and the need for food security in the local community; strategize on what additional resources are needed to bridge the gap between generators and consumers; and harness the resources, both internal and external, needed to bridge those gaps. Such a coalition can minimize confusion and resistance and maximize teamwork and efficient allocation of resources in the local community.

The WNOC coalition sees education as one of its primary roles. Because many potential donors were originally resistant to making donations because they were under the impression that the health department discouraged donations, it prioritized spreading the message that donations are not only allowed, but encouraged – and recruited the proper messengers to do so (Goldstein, 2016). The coalition created a “Food Recovery Task Force” in the pilot-program cities that are headed by restaurant owners, tasked with bridging the gap between fellow business owners and the local health department (Goldstein, 2016).

Such a partnership takes substantial initiative on the part of local leaders, however. In the case of WNOC, it took the leadership of the County Public Health Officer and Director of the County Food Bank to commit to bringing the stakeholders together, developing an outreach plan, and marshalling the public and private resources to build momentum (Goldstein, 2016). If a community lacks the dynamic individuals capable of inspiring change, framing state mandates as opportunities, or bringing a diverse group of players together toward a common goal, then it is more likely that stakeholders will be frustrated and conveners will believe it is a waste of effort to bring the stakeholders together.

Efficiency

Collaboration can increase efficiency by minimizing duplication of efforts and creating a system within which each stakeholder can play its unique role. It can also facilitate innovation by giving different stakeholders the opportunity to see a problem from different perspectives and create a previously unconsidered solution that meets multiple goals simultaneously. However, it will take some initial investment of time and resources on the part of the local government to effectively nurture a fledgling coalition. A person such as a high-ranking public health official would need to have the flexibility in his or her schedule to build a steering committee, so would therefore need to delegate responsibilities to other staff for his or her other duties while focused on food recovery.

The overall efficiency of coalition work also depends on the investment of the local stakeholders. If the attitude of generators is merely to avoid fines for landfilling food waste, they will likely not be as invested in all the benefits, from positive public

relations to helping alleviate hunger in the community. On the one hand, bringing the different interests to the table helps the group see the issue from different perspectives and find win-win solutions. On the other hand, Bardach (2012) cautions that "the openness that makes for improvability can also, by opening the door to hostile political interests, dimnish robustness" (p. 43). The leadership of the local recovery effort has a difficult task in balancing adequate participation to bring expertise and resources to the table against co-option of the process by interests that may have something to gain by creating exceptions or weakening the program in general. Coordinators may feel that they are pulling teeth rather than sparking a fire in such stakeholders, and may be less likely to sustain their efforts.

The particular financial condition of the local government may also be an issue. If the city or county is cash-strapped, it may be resistant to any additional programs that it believes would make its situation more dire. The more flexibility the department has to allow staff to be released from their traditional duties, and instead assume leadership on food recovery, the better the outcomes likely will be. The same holds true for the physical resources of the department: the more meeting space and technology resources it can lend, the more the coalition can do its work.

Score: 4

Equity

As discussed above, a more rural or poor community will likely not be positioned as well to bring together stakeholders as a more densely populated and resourced community. Such a community may have less food to share, more food insecurity among

the population, and more logistical challenges in regards to distance and lack of infrastructure.

However, overcoming the greater barriers to adequate food recovery that such communities may face likely makes collaboration even more important. When resources are scarce, it is even more important to use them as efficiently as possible. While it would require an initial investment of time and resources to build relationships with food rescue organizations, the investment would likely pay off by building the confidence in donors that they will be able to cost-effectively meet state requirements. It would also allow donee organizations the opportunity to coordinate their efforts and feel connected to a larger network rather than remain isolated in doing their individual work.

Score: 3

Implementation

This intervention will certainly take effort to implement, but given the fact that local governments are mandated to develop a plan to meet recovery and recycling requirements and report their plan to the state, coordinating that effort with all the stakeholders at the table will likely facilitate that process rather than be an onerous task in its own right. The critical unknown factor is what level of investment and skill the leadership of a local recovery effort has.

Nambisan (2008) recommends local entities develop four areas of capability and competency in collaborative efforts. He suggests that entities should cultivate a culture of openness; create an appropriate organizational structure; develop appropriate leadership and relationship skills; and adopt ways to track relevant successes. He notes that by

cultivating a culture of openness, the entity allows outside organizations to take ownership of innovations where appropriate, and communicates trust that a genuine partnership exists between the government and external stakeholders. By creating the right organizational structure, the entity can decide whether it will take a central coordinating and decision-making role, or be more of a facilitator of others' leadership (Nambisan, 2008). He suggests the entity consider dedicating a staff person to be "chief innovation officer" or perhaps a team of coordinators to do the work, depending on the level of leadership of the coalition. He notes that if the entity develops appropriate leadership and relationship skills, it can train its employees to understand the asymmetry of power between the government as potential enforcer, and generators and rescue organizations as regulated entities. He suggests that as a consequence, entity staff will be better prepared to communicate in ways that build trust rather than resentment. He notes that by choosing and tracking relevant metrics, the entity will have objective data to offer recognition to successful partners and to offer feedback and redirection when appropriate. These metrics could count the number of generators who have implemented a recovery program, the meals recovered compared to the meals served to donees, and the number of people served, among others. Many of these metrics are explicitly designated in the SB 1383 regulations, but could be supplemented by metrics appropriate to the specific entity's recovery system.

WNOC benefitted from early leadership from both the Director of Public Health and the Director of the local food bank (Goldstein, 2016). These leaders recognized the importance of building relationships with generators, and have passed on leadership to a

restaurant owner who was an early proponent of the program (M. Learakos, personal communication, April 10, 2019). Without clear vision and dedication from someone with authority, it will be difficult to implement even a well thought out plan. This authority could come from the local government's power to fine generators for failure to meet recovery requirements. I would argue that a more productive source of authority would stem from the trust built from supportive and collaborative relationships, as the relationships developed by WNOC seem to be.

Businesses will eventually be required to reduce their organic waste disposal under the regulations, so they will likely be enthusiastic to participate in a process that gives them access to information about how to donate and who to work with to meet the requirements. The local government will have to harness the expertise of existing staff, or consult with existing recovery coordinators to develop and maintain such a system. As discussed above, attention to coalition-building would necessarily require time away from a coordinator's regular duties, and may oftentimes require new staff to handle the expanded responsibilities and areas of expertise. It also requires meeting facilities for in-person gatherings or technological support for remote communication. CalRecycle, as the repository for each jurisdiction's submissions of plans to implement recovery, likely has an important role to play in identifying "best practices" and supporting communications between systems to help jurisdictions learn from each other so they can minimize the mistakes made along the way.

Score: 4

Feasibility

Building a coalition of stakeholders is voluntary and collaborative. There is likely little risk that a stakeholder would stir up political resistance or bring a legal challenge to a collaborative process that seeks to build common understanding between players. Because of the public investment of time and resources required, there could be some resistance to the extra expenditures, but given the statewide mandate on both local governments and businesses, such resistance will likely not be separate and distinct from resistance to the requirements in general.

Score: 5

Sustainability

In much the same way as the discussion of infrastructure investments above, the point of creating a collaborative process to educate and build relationships between stakeholders is to overcome initial information gaps and resistance to changing business practices, with the hope that once new practices are established, they will be self-sustaining. WNOC has reported that once local businesses adopt a rescue plan, they are not only encouraged by the fact that the process is not as onerous as they feared, but that their trash-haul costs go down as well. Linking positive behavior with a benefit to a business' bottom line helps that behavior continue indefinitely.

There is always the problem of attrition, however. If the coalition falls by the wayside because the system is working adequately, and the key players move on to other issues, new businesses may be less likely to tap into existing resources and struggling

businesses may make a decision that it is not worth the effort to manage excess food, particularly if enforcement also gets complacent.

Score: 4

Table 7

Alternative #3 Outcomes Matrix

	Efficiency	Equity	Implementation	Feasibility	Sustainability	TOTAL
Raw Score	4	3	4	5	4	21
Multiplier	6	5	4	3	2	
Weighted Score	**24**	**15**	**16**	**15**	**8**	**78**

Alternative # 4: Encourage Use of Donation-Match Software

Probable Outcomes

Given the ubiquity of smart phones, it would be unwise not to consider harnessing the potential of social networking as an important tool in a local food recovery network. Potential food transporters have in their pockets at all times a notification device that can alert them when excess food becomes available, and then use Global Positioning System software to direct them to a suitable drop-off location where the food could be used. Any smart phone user who has used a mapping application to follow driving directions would likely be able to use a food recovery software app to navigate to where the food is located and then navigate to the recipient site. The integration of software into a food recovery program has the potential to massively expand the system's capacity to deliver food from one location to another, make the system much more dynamic and flexible, and reduce

overhead by empowering volunteers to join the effort. Harnessing technology would likely have positive side-effects as well. It may attract more media attention to the efforts of the program, make the system more popular with tech-savvy younger citizens, and may attract investment in technological innovations spearheaded locally.

However, it is often a mistake to assume that technology is a cure-all for any problem. As discussed in chapter three, 412 Food Recovery's technology is undergirded by human operators' capacity to make judgment calls about where is the most suitable place to send excess food. For instance, when a donor calls in a large volume of produce, it makes no sense to send it to a distributor with no kitchen to process and divide the donation into manageable units. Conversely, if the food is already in a prepared form, hot and ready to eat, it would be best to send it to a location where it could be consumed immediately rather than sent to a distributor that only provides services a few designated days each week (M. Cronin, 412 Food Rescue Program Manager, personal communication, December 12, 2018). Once staff make the determination, however, their software system sends a push notification to potential transporters, and the first person to respond gets to be the one who makes the delivery. It is important to acknowledge that even a technologically-advanced intervention will likely require additional human expertise and commensurate salary to guide and refine the system.

It is common knowledge that framing work as a game is a strong motivator for people, and the use of technology in food rescue has enormous potential to not only expand capacity, but to engage the community in fun and friendly competition. Building a system that keeps track of participants' number of transports, miles traveled, and meals

saved has the potential to spark interest in a wide segment of the community and maintain their involvement over time. While a carefully-crafted system would also consider possible negative side effects such as dishonest or unsafe behavior, these problems could likely be minimized by cautious implementation and adequate oversight of the program.

Efficiency

ReFED's economic efficiency analysis placed donation-matching software at the top of its chart of most promising recovery interventions (2016a). By its calculations, implementation of donation-matching software would cost very little to implement, but would add nearly $3,000 of economic value to the community per ton of food recovered (2016a). Potential benefits include increased employment for call coordinators and transporters, as well as decreased disposal costs for generators. In addition to the economic benefits, it is also important to acknowledge the social and environmental benefits that will likely accrue in the form of reduced strain on the health care and waste management sectors, not to mention the reduced GHG emissions that are the driving force behind the policy.

The established presence of ride-hailing services such as Uber and Lyft would make implementation of donation-matching software even more compelling from an efficiency standpoint. Drivers are already out on the road looking for opportunities to transport passengers. If a separate app on their phone alerted drivers to food recovery as well as passenger transport opportunities, drivers could very well "feed two birds with one scone" by transporting people in the seats and food in the trunk. Even if not paid at

the same rate, drivers could be encouraged to participate with a nominal fee paid by the generator or in "recovery points" in pursuit of recognition as mentioned above. Private drivers could be particularly helpful outside of normal business hours, when agency vehicles are likely dormant. Of course, this may require some distribution agencies to rethink their schedule to allow for late-night drop-offs and overnight storage until they could distribute the food the following day. Given the ride-hailing companies' army of coders, and recent critiques of labor and management practices, there may be ample opportunity for food recovery organizations to work with ride-sharing companies to integrate applications to serve multiple functions. This would not only help the companies repair good-will in the communities they serve, but may also be more efficient than a stand-alone rescue app. Uber's recent integration of Jump bikes and scooters into their ride-sharing app shows the app's flexibility for multiple uses, so the addition of a food recovery layer seems feasible.

Score: 5

Equity

Donor-matching software will likely face similar challenges as other interventions: tech-savvy and wealthier urban areas will have a greater abundance of people willing and able to transfer their ride-hailing experience toward food recovery. More rural and poorer areas will have fewer drivers, and the distance between locations will likely be greater as well. However, the fact that software developed for one locality could easily be ported to a different locality may make start-up costs relatively insignificant, allowing later adopters to benefit from the lessons learned by trial and error.

In fact, ReFED noted that there are "white label" versions of software being developed that establish common infrastructure, but that can be re-branded for a particular jurisdiction (ReFED, 2016a). The ubiquity of GPS-capable devices in both rural and urban communities mean that there would be very little need for investement in hardware regardless of where the program is implemented. Given the potential for engagement of volunteers discussed above, some careful and creative thinking on the part of local recovery organizations could link food recovery with local pride in ways that could make recovery a community effort without an unreasonable financial investment.

Score: 4

Implementation

Donation matching software will likely not be wholly autonomous. One effective program, Pittsburg's 412 Food Recovery, includes a human element that understands what types and amounts of donation are appropriate for which recipients. Human intermediaries can also get feedback from recipients about any problems they have regarding the quality of the food they receive from donors and communicate to the donor how it can improve its practices (M. Cronin, personal communication, December 12, 2018). The ability to build relationships with donors and meet the needs of recipients has made 412 Food Recovery's model an attractive option; it has been adopted by several other cities, including San Francisco. The need for coordinators necessarily adds a layer of complexity and expense to the implementation of this intervention.

Donation matching software will likely not thrive in a vacuum. It will need to be one component of a well thought-out recovery network, where traditional large-scale

recovery will likely operate during normal business hours and smaller on-demand recovery will fill in gaps during other times of day. Therefore, jurisdictions will need to consider how best to allocate limited resources to the many moving parts of their recovery network. They may need to prioritize the larger and more stable sources such as grocery stores and wholesale markets at the expense of investing in smaller-scale recovery that requires coordination between many more players. Given the estimation that as much as a third of currently wasted edible food comes from restaurants, however, creating a flexible system that can provide on-demand recovery should be a key component of a local recovery system. Because many jurisdictions, including several in California, have already incorporated the use of software into their recovery efforts, smaller jurisdictions may be able to borrow a page from an already existing playbook to incorporate the use of software into their plan in a relatively cost-effective manner.

Score: 4

Feasibility

Opening up food recovery to a wider group of non-traditional rescuers would mean that health departments need to devote significant attention to maintaining the health and safety of donated food. If a forgetful transporter allows food to sit in his car for too long and someone gets sick as a result, while the Good Samaritan law would likely protect the donor and transporter from legal liability, it could be a significant deterrent to recipients to accept food from lesser-known sources, and could likely shift public opinion against donation matching software specifically or food recovery more generally. Local governments will need to craft their system carefully to allow for the

greatest amount of participation while minimizing the possibility for harm to occur as a result of wide participation.

Score: 3

Sustainability

As discussed above, involving a wide swath of the local community in food recovery in a way that builds civic pride and involves friendly competition has the potential to last well beyond the government's involvement with the intervention. As the system becomes established, governmental guidance could likely give way to private management of software and the recovery system it facilitates.

While it would remain important for the local government to continue to provide oversight to ensure that food safety requirements are maintained, as the community becomes more experienced with effectively transporting food, that oversight will likely become standard operating procedure and will be needed most to bring new transporters up to speed. Much of that training and supervision will likely come from the rescue organizations themselves.

Score: 4

Table 8

Alternative #4 Outcomes Matrix

	Efficiency	**Equity**	**Implementation**	**Feasibility**	**Sustainability**	**TOTAL**
Raw Score	5	4	4	3	4	20
Multiplier	6	5	4	3	2	
Weighted Score	**30**	**20**	**16**	**9**	**8**	**83**

Comprehensive Weighted Outcomes Matrix

The compiled results of the Criteria-Alternatives Matrix Analysis are presented in the following table. It compares data from the overall scores of all four alternatives. I will turn to an analysis of these relative scores in chapter six.

Table 9

Comprehensive Weighted Outcomes Matrix

	Efficiency	**Equity**	**Implementation**	**Feasibility**	**Sustainability**	**Total**
Health Inspectors	18	20	20	12	8	**78**
Infrastructure	18	10	12	9	6	**55**
Collaboration	24	15	16	15	8	**78**
Software	30	20	16	9	8	**83**

Chapter 6: Discussion, Recommendations, and Conclusion

In this final chapter, I will discuss the results of the CAM analysis conducted in chapter five, with a focus on the policy implications of the results. Based on the outcome that Donation Matching Software (Alternative #4) scored the highest with an overall score of 83, with Health Inspectors (Alternative #1) and Collaboration (Alternative #3) trailing close behind with scores of 82, I will provide a policy recommendation, as well as discuss possibilities for further research.

Results of the Criteria-Alternatives Matrix Analysis

A CAM analysis should not be interpreted as a definitive determination of the "best" policy choice. It is inherently subjective according to the biases and preferences of the analyst, and is necessarily based on incomplete information that cannot take into account the particular political landscape of a jurisdiction or the policy preferences of its officials. Despite its limitations, a CAM analysis still remains a powerful and flexible tool that can assist policy-makers in understanding a problem from multiple perspectives and guide possible choices that are often limited by resources and political constraints.

In this thesis, I conducted a CAM analysis to analyze four alternatives that could potentially assist local jurisdictions in meeting their 20% edible food recovery requirements as mandated by SB 1383. The four alternatives were diverse in their approach to address the problem of wasted food and effective recovery. One focused on enlisting local health departments to encourage food waste generators to change their behavior; another looked at the gap between generators and consumers and encouraged investment in transportation and storage to safely deliver food between organizations; a

third promoted collaboration between all stakeholders; and the final approach encouraged the use of technology to make food recovery more time-sensitive and community-driven.

To determine the "best" policy, I analyzed each policy against five weighted measurement criteria. I carefully chose the criteria to maximize the likelihood that the local government that implements a policy choice will be ultimately successful in reaching its 20% recovery goal.

Out of the four alternatives I analyzed, one scored relatively low, one scored relatively high, and the two moderate scores were equal. The results from chapter five are repeated below for reference.

Table 10

Comprehensive Weighted Outcomes Matrix

	Efficiency	**Equity**	**Implementation**	**Feasibility**	**Sustainability**	**Total**
Health Inspectors	18	20	20	12	8	**78**
Infrastructure	18	10	12	9	6	**55**
Collaboration	24	15	16	15	8	**78**
Software	30	20	16	9	8	**83**

Investment in recovery infrastructure scored the lowest, with a total of 55 out of 100 possible points. This alternative scored the lowest or tied for lowest in all categories. Engaging public health inspectors in outreach to businesses about recovery and collaboration between stakeholders fared better with a total score of 78, but still lagged behind the top alternative. While the public health inspector alternative scored well in the equity and implementation categories, its lower score in efficiency was the primary

difference between it and the top alternative. Collaboration had a higher score in efficiency, a moderate score in equity and implementation, and top scores in feasibility, and sustainability. The final alternative, using donation-matching technology, earned the top score of 83 points. A top score in efficiency and equity enabled it to attain the top spot even though it had lower scores in implementation and feasibility.

Policy Recommendations

Based upon the results of my research, I am able to make several recommendations to policy-makers concerning strategies to recover edible food to meet the mandates of SB 1383. First, I recommend that policy-makers adopt the use of donation-matching technology (Alternative #4). This alternative scored the highest in the CAM analysis, appears to maximize benefits while minimizing costs, and would be fairly equitable in how costs and benefits would be distributed across the state. In addition, a jurisdiction should consider using health inspectors to promote food recovery (Alternative #1) and should consider facilitating collaboration between stakeholders (Alternative #3), as these interventions would be complementary. While using health inspectors scored relatively low because it only encourages generators to donate without addressing the infrastructure needed to rescue food, and technology implementation scored relatively low because of the chance of political resistance to wide-spread volunteer efforts based on fear of lax food safety, simultaneous outreach and collaboration could ensure communication between local health departments and donation-matching efforts in order to make sure volunteers are properly trained and supervised.

It is important to remember, however, that even if one idea could be determined to be objectively superior to other ideas, the given success of that alternative depends on the particular economic and political environment of that locality. The "best" alternative also depends on the priorities of the policy-makers for that jurisdiction. It is also important to acknowledge that implementing more than one alternative simultaneously could possibly have multiplicative effects. Particularly here, where each alternative focuses on a different aspect of the edible food waste problem, different policy solutions wouldn't necessarily thwart the efforts of a different policy, but could likely have the effect of creating a positive feedback loop: information can lead to awareness; awareness can lead to investment, investment can lead to word-of-mouth enthusiasm, enthusiasm can bring more people on board, and more people can bring greater awareness and elevate the issue in the press, public conversation, and within governing bodies.

With that said, I now turn to the particular ways that adoption of donation-matching software, alone or in some combination with the use of health inspectors or stakeholder collaboration, could result in significant gains in edible food recovery for a given jurisdiction, without creating too great a strain on local government or the local economy.

Implementation of Donation-Matching Software

Alternative #4 encourages integration of the use of donor-matching software. It is efficient because there are many successful models and already-developed software from which to choose: WNOC uses ChowMatch, which is now in its fourth major revision, and is used by more than 500 jurisdictions (ChowMatch, n.d.). WNOC also provides training

modules for its volunteer drivers online, which another jurisdiction could use freely or adapt for its own circumstances (WNOC, n.d.). San Francisco has recently adopted 412 Food Rescue's hybrid system that uses human intermediaries between donors and recipients, then uses push notifications to locate an appropriate driver (Karidis, 2018). ReFED predicts that many different developers will create recovery software, and that a handful of the best systems will scale nationwide (ReFED, 2016a). It also reports that several food recovery organizations are assessing whether it makes sense to develop a white-labeled version that could share the same underlying software infrastructure but allow for branding for individual food rescue systems (ReFED, 2016a). Jurisdictions will need to spend time and money assessing which software would be the best choice for their food recovery system, and would also need to consider on-going operating costs for the different packages. However, the fact that substantial innovation has already occurred, and additional opportunities exist for collaboration with ride-sharing companies, it is likely that the use of technology would be an efficient addition to a jurisdiction's recovery plan.

Donation-matching software also scored high on equity and implementation. As mentioned above, less wealthy districts will likely be able to take advantage of the work of other jurisdictions, so will likely not need to invest in as much experimentation, but can instead choose a software based on the feedback from other localities. While rural areas may need to account for greater per-pound costs because of travel distances and a smaller pool of volunteers, it is also likely that less recovery will need to occur for smaller jurisdictions to meet their 20% recovery requirements. Because donation-

matching software will likely not be the core component of a food recovery system, but will instead fill in gaps left unserved by larger-scale recovery efforts, a jurisdiction can implement software as it identifies needs and better understands how technology can supplement its existing recovery system.

This policy alternative does require some thought regarding implementation to avoid public backlash because it opens up food transportation to a wider pool of the populace. Using WNOC's training modules, and implementing training and oversight for rescuers, can minimize potential for mishandling of donations. The regulations' assurance to recipients that they can refuse unwanted donations will also mean that health risks from delayed deliveries will likely be reduced (CalRecycle, 2019). Finally, alternative #4 would be relatively sustainable because it has the potential to bring many people in a community together for a common goal, and when the up-front work to establish such a system is done and the community has ownership and pride about the project, government's role can be relegated to oversight of the organizations that keep the system running.

Implementation of Health Inspector Outreach

Alternative #1 empowers local health inspectors to promote edible food recovery as they are conducting inspections of regulated food distribution establishments. It is a moderately efficient alternative because while it would not add a lot of additional infrastructure costs to the existing duties of health inspectors, who visit food distributors as part of their current duties, it will require some expenditures for retraining of staff, or possible hiring of more capable staff who can balance the possibly conflicting messages

of disposing of food at the earliest signs of spoilage and retaining food for as long as possible to transfer it to a food rescue organization. It is limited in its effectiveness, however, because without the development of an effective recovery system, simply educating generators of the importance of donating food does not necessarily lead to increased recovery. It could instead lead to donation dumping, where non-profits accept food that they may not be able to repurpose for fear of alienating a willing donor, but end up disposing of the food themselves.

It is an equitable solution because all counties are already required to do outreach to regulated businesses. Adding a layer of complexity to their work would likely impact different locations in similar ways. It would also be relatively easy to implement, because while there may be additional training required of inspectors, there wouldn't be extensive infrastructure investment required, nor complex collaboration with a range of different organizations. The logistics would essentially remain within the local health department.

As for feasibility, a given jurisdiction's resistance to the message of recovery will likely be dependent on the relationship between the health department and its regulated entities. On the one hand, if inspectors use the next few years before penalties begin to help ease the transition for the implementation of food recovery, then businesses are likely to be grateful, rather than hostile, to inspectors' message. On the other hand, if the perception is that the health department is simply adding another layer of responsibility on top of already onerous regulations, then there could be significant political resistance. Sustainability has similar considerations. If inspectors can play a role in establishing expertise in businesses to have confidence in how to access the food recovery system,

then once those relationships and systems are established, the inspector may have little more to do, other than educate new businesses and keep current with local resources. If a business is donating primarily because of a fear of penalty, then as soon as regulation is tapered off, effort to recover rather than dispose of food waste will like taper off as well.

Implementation of Stakeholder Collaboration

Alternative #3 encourages collaboration between stakeholders. It is a relatively efficient alternative because it does not require the expenditure of significant funding, yet has the potential to create substantial results. It essentially asks the local government to be a convener for both governmental and non-governmental organizations to put their heads together and develop a plan for edible food recovery city- or county-wide. The actual work is done in partnership, rather than falling on the government to do all the work.

WNOC has managed to assemble more than 200 distribution organizations and more than 400 businesses in its food recovery network since its inception in 2012 (Mugica, Spacht, & Henly, 2017). Its efforts led to the recovery of more than 5 million meals during the first half of 2017, more than it recovered in all of 2016 (Mugica, Spacht, & Henly, 2017). The coalition includes representatives from the food industry, public health departments, food banks, hospitals, and charities (Mugica, Spacht, & Henly, 2017). This allows the recovery system to be informed from multiple perspectives and facilitates a more holistic system in the long run. Because health care professionals are invested in food recovery, the coalition has developed a network of doctors who use a screening tool to identify which families they serve are food insecure (Mugica, Spacht, &

Henly, 2017). Because businesses are represented, they have developed effective ways to communicate to fellow businesses about liability protection and encourage donation in a non-threatening way (Mugica, Spacht, & Henly, 2017). Because a cab company has come aboard, the system has a network of late-night drivers that can fill transportation gaps when typical businesses are closed for the evening (Mugica, Spacht, & Henly, 2017).

The alternative should not be overwhelming to implement because it makes work that counties are required to do easier rather than harder. Not only does it make sense for a local government to coordinate efforts to maximize efficiency, but as capacity planning is required under the proposed regulations promulgated under the authority of SB 1383, governments will likely save tremendous time and effort by taking the initiative to assemble stakeholders, rather than attempting to fulfill the regulations' many requirements on their own. For example, each county must identify the amount of edible food that will be disposed of by generators; identify existing capacity to recover that food waste; identify "new or expanded" food recovery organizations that will be used to process excess food; and identify how much capacity its existing recovery organizations will need in order to meet the 20% requirements of SB 1383 (CalRecycle, 2019). If a county acknowledges that it lacks the capacity to meet the requirement, it must create an implementation plan, including funding sources and facility expansion that it will need to meet the requirement, and include an implementation schedule with the timing of when the jurisdiction will meet recovery milestones (CalRecycle, 2019).

As if this daunting task didn't already send county officials racing to their phones to begin creating a coalition, the regulations also make it explicit that the county must

consult with recovery organizations as it develops its plan (CalRecycle, 2019). While county officials are anxious about the implications that SB 1383 may have for cash-strapped budgets in general, Sacramento County waste management officials acknowledged that being conveners and repositories for information that could be used by multiple stakeholders are tasks with which they are comfortable (D. Sloan, D. Ghardelli, & E. Ozorak, Sacramento County Solid Waste, personal communication, November 9, 2018). It is important to keep in mind, however, that a local agency that leaves the expertise to the stakeholders, rather than retaining authority to make decisions itself, may open up the system to conflicting interests and pressure to make exceptions rather than hold the parties to high standards. In fact, one of the criticisms that the current executive director of WNOC has with the current draft of the regulations is that it requires large single-location restaurants to participate in recovery, but exempts restaurant chains whose individual stores are small but may have many locations (M. Learakos, personal communication, April 10, 2019). The more exceptions to participation that exist, the more those included may feel that the system unfairly burdens some while leaving out others that waste just as much.

The alternative is feasible because it has created a culture of cooperation between stakeholders in Orange County. WNOC has used its coalition to create enthusiasm for food recovery by effective branding efforts. The cab company that shuttles food during off-peak hours displays the WNOC logo in its cab windows. Businesses display the logo on restaurant windows. Marketing and educational publications also prominently display the logo. Because the public is exposed to WNOC's branding in many different contexts,

food recovery can seep into the public consciousness and become part of the community's identity. This likely has the effect of increasing the alternative's political feasibility because the stakeholders and the community see recovery as an asset, rather than a liability. By creating a culture of cooperation and ownership of food recovery, WNOC has also created a system that is sustainable, because now that systems are in place, stakeholders will continue to participate because they don't want to let other stakeholders down and because of the feelings of satisfaction and good will that continued participation supports.

Implementation of Donation-Matching Software, Use of Health Inspectors, and Collaboration Together

A combination of using health inspectors to educate donors, collaboration between stakeholders, and integration of technology would likely be complimentary in a food recovery system. Government's role in promoting collaboration is to use its connections within the community in order to link generators and recipients with available resources so they can learn how best to work together. This outreach effort seeks to bring as many stakeholders to the table as possible in order to create a food recovery system that plays to the strengths of the particular participants and identifies areas that will need additional strategizing or resources. Health inspectors hold a unique position because they already perform outreach to regulated entities. This empowers them to be the face of food recovery in the community. Similarly, incorporating the use of donation-matching software is also based on bringing as many individuals as possible into the recovery system. All three seek to bring together a diverse group to work toward

a common goal. All three will require education about the issue of food waste; sharing of information about how best to address the problem; and an offer for participants to become involved to take a piece of the work.

Using health inspectors to educate donors, encouraging collaboration, and integrating technology cannot, on its own, solve a jurisdiction's food waste problem. The three alternatives are complementary tools that are relatively inexpensive to implement and have the potential to distribute the work amongst many stakeholders. While the increase in participation necessarily makes the system more complex, it also increases the capacity of the system. The local government, as coordinator for the many tasks that will be a part of a recovery system, will need to be attentive and responsive to the information shared by stakeholders to determine what level of involvement is required to efficiently meet or exceed the recovery goals set by the state.

Future Research

As California jurisdictions become more experienced with food recovery statewide, several areas of research will help guide localities to design and implement effective and efficient recovery systems.

There is a lack of academic research that conducts quantitative analyses of state and local recovery systems. While ReFED's Roadmap offers nation-wide summaries of its prediction on the amount of potential recovery and cost-benefit analyses of particular interventions, it is difficult for an individual jurisdiction to understand how any particular intervention will play out on a smaller scale. Pre- and post-implementation studies of

different types of communities would give policy-makers more concrete case studies upon which to base their own intervention plan.

Another helpful project would be to develop a side-by-side comparison of technology options. This would help jurisdictions determine what software is right for their food recovery system. The comparison could show the different features each system offers, and how much the system would cost to implement and maintain. This would allow a jurisdiction to decide what features are worth the initial and ongoing investment, depending on its budget.

Policy makers should also take a step back from the immediate issue of recovering food waste to consider the broader issue of hunger in general. It would be prudent to ask ourselves why we must resort to feeding the needy with cast-off food, rather than reducing our production of food to only that which we need and developing the capacity of all Californians to meet their own needs independently.

It would also be beneficial to revisit SB 1383's provisions that prioritize edible food recovery for humans, but say nothing of recovery for animal feed. According to the Food Recovery Hierarchy, it is more efficient to feed animals with scraps than sending them to be composted or anaerobically digested. While true that our current consumption of animals does contribute to methane emissions by virtue of raising livestock, minimizing the methane produced in growing their feed should be part of the state's overall methane reduction plan.

Conclusion

This thesis used Bardach's (2012) method to analyze several potential policy alternatives for local governments to consider when developing a food recovery system designed to meet SB 1383's requirement that each local jurisdiction shall recover at least 20% of currently disposed food for human consumption. It used his eight step method to create a Criteria Alternatives Matrix to be able to do a side-by-side comparison of different alternatives according to a selection of relevant evaluative criteria. While Bardach's method is an inherently subjective one, it attempts to be transparent in allowing the reader to understand the analyst's perspective and justifications for choosing one policy alternative over another. If the reader wishes to modify the emphasis on a given criterion to reflect his or her own values, the framework allows for a different weighting of the criteria, which will necessarily lead to different outcomes.

In chapter one, I introduced the issues facing local jurisdictions as they grapple with the significant implications of statewide legislation to address greenhouse gas emissions, and specifically how SB 1383's substantial limitation on jurisdictions' ability to landfill organic waste requires that those jurisdictions implement organic waste reduction policies. I discussed some of the background that led to the passage of SB 1383, and the challenges that face local governments as they take steps to implement its requirements.

In chapter two, I explored the literature that has attempted to understand the problem of food waste and how recovery can be one intervention to lessen the problem. Because edible food recovery is a relatively new area of research, I did not rely as heavily

on peer-reviewed research, and instead had to turn to studies and reports conducted by non-profit organizations, waste management-focused periodicals, governmental organizations, and interviews with industry professionals. I used these studies and interviews to guide my understanding of potentially-effective policy interventions.

In chapter three, I used my literature review to narrow the possible alternatives to four promising options. I began this process by introducing policies that have either been implemented successfully or that have the potential to be successful if implemented more broadly, according to experts in the field. I then created a list of alternatives from those I found to be most promising, and also considered the impact of allowing present trends to continue. I ultimately chose four alternatives to include in my CAM analysis.

In chapter four, I described the criteria by which I evaluated each policy alternative. In order to choose the criteria, I carefully considered what outcomes would be most important in the final policy that I ultimately recommended, keeping in mind Bardach's advice about what characteristics make a policy more likely to succeed. I chose five criteria by which to measure my alternatives, and I weighted the criteria according to my best estimate of which criteria are most important to achieving successful implementation of a given policy.

In chapter five, I conducted the CAM analysis. I first outlined the methodology used to conduct the analysis. I then looked at each alternative individually, and evaluated it against each criterion. I gave each policy a score from one to five for each criterion, then multiplied the raw score by the relative weight given each criterion. This allowed side-by-side comparison of the different alternatives using a familiar 100 point scale. The

alternative with the highest overall score was the one that my assumptions led me to assert will have the highest probability of achieving the desired policy outcome. Because two of my alternatives were very close in their overall score, I explored both in greater detail in chapter six, where I offered policy recommendations to local governments tasked with implementing oversight of edible food recovery in their jurisdictions.

As a result of my analysis, I have presented local policy-makers with a foundation upon which to base discussions about implementing edible food recovery in their jurisdiction. While there is likely considerable uncertainty about how to implement the many requirements of SB 1383 without an influx of additional resources to do so, edible food recovery is clearly an effective way of reducing food waste that will not only be more cost-effective than compost or anaerobic digestion, but also has the potential to reduce food insecurity, provide employment opportunities, and create community spirit as people come together from many perspectives to achieve a common goal. If local jurisdictions implement their food recovery plan early in the process, before they become enforcers of a mandatory policy, they can seize the opportunity to be a partner with a wide range of stakeholders toward the common goal of transforming potential waste into a valuable commodity that literally feeds the community.

APPENDIX A

Results from CalRecycle's 2014 Disposal Facility Waste Characterization Study

The Disposal Facility Based Study divided the state into five regions defined by similarities in demographics, climate, geography, and economy. Sites were then selected at random within each region, and researchers gathered 754 samples from 26 solid waste facilities over the course of four seasons, with roughly the same number of samples from each region. Results in regards to food waste are summarized in Table A1. [1]

Table A1

Results from Disposal-Based Study

Hauler Type	All Waste (in tons)	Food Waste (in tons)	Food waste as % of total waste generated
Commercial	11,909,937	2,390,922	20.1%
Single-family Residential	10,924,313	2,293,394	21.0%
Multi-family Residential	3,591,900	888,327	24.7%
Self-hauled	4,438,130	18,535	0.4%
Overall*	30,864,279	5,591,179	18.1%

* slightly off due to rounding.

From "2014 Disposal Facility-Based Characterization of Solid Waste in California," by CalRecycle, 2015, (https://www2.calrecycle.ca.gov/Publications/Details/1546).

[1] These numbers may not be accurate – CalRecycle noticed an anomaly in its data: "Compared to previous studies, there was a steep increase in the portion of the waste stream attributable to the residential sector, with a comparable steep decrease in both the commercial and self-hauled sectors. A region-by-region analysis showed that the Southern Region had a massive change in its residential/commercial split when compared to previous studies. Since that region accounted for more than 60 percent of the state's disposed waste, even small changes there create substantial changes in the statewide results" (p. 3). The Department therefore also analyzed the 2014 waste amounts using the 2008 sector percentages for comparison. The difference was only a few percentage points for food waste overall (16.5% compared to 18.1%).

APPENDIX B

Results from CalRecycle's 2014 Generator Waste Characterization Study

The Generator Based Study took samples from 837 unique commercial waste generators, with representation from the same five geographical regions as the Disposal Facility Based Study (CalRecycle, 2014a). One 200-pound sample was analyzed from each participant (CalRecycle, 2014a). Businesses were grouped according to factors such as having similar waste profiles and purposes; focusing on businesses that produced a significant amount of organic waste; and focusing on industries with high employment in California (CalRecycle, 2014a). Businesses with less employment and fewer landfill-diversion opportunities for their waste were put into a single group (CalRecycle, 2014a). The construction industry was excluded based on the assumption that its waste is produced at the work site rather than the office site, and readers were directed to the Disposal Facility Based Study for more information on that industry's waste characteristics (CalRecycle, 2014a). In total, the department created 16 industry groups (CalRecycle, 2014a). Significant findings are summarized in Table B1, sorted by tons of food waste produced.

Table B1

Results from Generator-Based Study

Generator Type	All Waste (in tons)	Food Waste (in tons)	Food waste as % of total waste generated
Restaurants	2,876,653	1,461,319	51%
All Other Retail Except Food and Beverage	2,433,989	437,469	18%
Services – Management, Administrative, Support, and Social	1,514,667	376,502	25%
Services – Professional, Technical, and Financial	3,994,643	330,452	8%
Arts, Entertainment, and Recreation	829,661	278,639	34%
Manufacturing – Food and Non-durable Wholesale	582,486	220,403	38%
Medical and Health	1,003,316	216,983	22%
Education	562,442	189,957	34%
Food and Beverage Retail	417,791	173,504	42%
Hotels and Lodging	384,327	123,483	32%
Other*	1,936,689	227,037	12%
Overall Commercial Waste	16,536,664	4,035,748	24%

*Groups that did not generate a large amount of food waste were lumped together.

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