FRAMING FOOD WASTE: INCENTIVES FOR CHANGE

by

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Food waste in the United States is a large-scale issue that impacts international and national food systems. The core consequences of food waste are environmental damages, economic losses and exacerbating social costs inflicted by the food industry. By consuming energy, water and land to produce food that is never eaten, food waste causes significant inefficiencies within the food industry. In the United States, 40 percent of food produced for human consumption is wasted. Awareness and concern are growing among the general public. However, reducing food waste requires the implementation of solutions on a systematic level. This thesis answers the research questions: how should the issue of food waste be framed, what current incentives promote food waste, and how can incentives reduce food waste and reform the food system? Food waste prevention is first framed as an all-encompassing food movement. This thesis then explains the current incentives that promote food waste and explores the deep-rooted reasons that initiate food waste. Finally, incentives for change are presented to encourage food waste mitigation. Throughout this thesis, food waste prevention is framed as a pivotal role in the reformation of the food system.

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Framing Food Waste

The Food Waste Movement

Food waste has emerged as a national and international issue encompassing concern about the general public's alienation and personal disassociation from the origin of food. Although the phenomenon of awareness and concern is growing among United States citizens, the issue of food waste has been brewing since the beginning of civilization. The Old Testament addresses the ethics of food excess by advocating for the development of grain reserves rather than wasting surplus crops (Pollan, 2006). The book of Leviticus specifically speaks to the redistribution of food waste to the poor, stating, "When you reap the harvest of your land, do not reap to the very edges of your field…Leave them [the gleanings] for the poor" (Leviticus, 23:22, New International Version).

Despite its deep roots, food waste has progressively become a serious problem in the United States. The rise of industrial food production, cheap food prices, and an overall growth of affluence have prompted people in the United States to form a disconnect with both the origin of food and the consequences of waste. The general public has been turning their eyes away from the negative impacts of the food industry, in which food has become a "disposable commodity" (Pollan, 2012). The disconnect between food production and the final product, alongside a lack of awareness, have become so prominent that the United States wastes up to 40 percent of food produced for human consumption (Royte, 2016). The amount of waste translates to at least 133 billion tons of the 430 billion tons produced each year (Aubrey, 2015). The amount

wasted is enough food to fill 44 Sears Towers (Aubrey, 2016) and provide 1,249 calories per person per day (Buzby, Wells, Hyman, 2014). If the United States cuts food waste by 15 percent, the amount of food no longer wasted can feed 25 million hungry Americans on an annual basis (Gunders, 2012). One in six Americans lack a secure supply of food, 1 billion people in this world are undernourished, and across the globe demand is increasing due to increasing population and affluence (Gunders, 2012). Food waste prevention has the capacity to reform the food system by redirecting food away from bins and landfills to feed the people in need.

Food waste in the United States and other More Developed Countries (MDCs) occurs for very different reasons than in Less Developed Countries (LDCs). Food waste in LDCs is often linked to industry infrastructure such as poor refrigeration and transportation (Stuart, 2009). In MDCs, food waste is often caused by structural elements of the food industry, such as retail management that tends to over-stock grocery store shelves. Wealthier citizens often waste food due to matters of convenience, such as cooking large portions of food and throwing out leftovers. Within the United States, cultural norms and policy measures provide incentive for farmers, retailers, and consumers to waste edible food. Consumers and retailers select produce for its aesthetic appearance and uniformity, rather than nutritional value. Fruits and vegetables that are not aesthetically appealing are wasted, as they have no value to farmers due to lack of retailer and consumer demand. Valuing appearance rather than true quality of food is a cultural norm that contributes to food waste (Royte, 2016). All of these reasons will be explored in the section *Current Incentives Promote Food Waste.* Food waste in MDCs prevails along the entire food chain in production,

transportation, packaging and as plate waste. Thus, “all rich countries in the world…have between 150 and 200 percent of the food that they actually need” (Rustemeyer & Baldwin, 2014, 36:33).

In the United States, the majority of waste occurs towards the latter half of the food system. However, the estimates of amount or percent wasted vary by source. The only complete USDA report that includes amount, value, and calories of wasted food excludes food wasted at the farm (Buzby et al., 2014). This report’s estimate, from which many media sources have obtained the 30-40 percent food waste statistic, shows that 31 percent of food is wasted at the consumer and retail levels. The number rises to 40 percent when the farm level is included (Buzby et al., 2014). On the other hand, Tristram Stuart, a renowned food waste prevention activist and author, estimates that 50 percent of food is wasted in the United States (Stuart, 2009). His estimation includes inedible food that could be used to feed animals as well as inadvertently rotten or damaged food (Stuart, 2009). Overall, food can be measured by the loss of monetary value, nutritional content, weight, or caloric content. Each unit of measurement presents different challenges. Nutritional and caloric content require extensive research and tedious data collection. Measuring monetary value includes tedious economic research. Weight involves time and labor to obtain physical measurements. Because of the differing ways to categorize and measure food waste, a range of estimates results. Regardless of the precise percent wasted, the amount of food waste in the United States is unarguably extreme and the points in this paper apply.

Alongside the challenge of measuring food waste, national food waste has a complex link to the global food system. A full cycle analysis of the worldwide food

system indicates the effect national food waste has on ecosystems, economies and communities across the globe. One way to approach a full cycle analysis is through sustainability, which is a "unifying principle for thinking about ways of improving the food system in a multi-dimensional fashion" (Hill, 2014, 07:40). Regarding food systems and sustainability, it is impossible to address one area of the world without looking at the global system. If the scope is too narrow and looks only at one aspect of the food system, solutions end up counterproductive because the system is so vast and interlinked (Hill, 2014). The full cycle analysis on sustainability can be applied to the issue of food waste. Purchasing food in the United States, whether it is eaten or wasted, impacts the long chain of global food production. This paper focuses on food wasted in the United States, while also addressing the international implications that arise due to the interconnectedness between domestic production and consumption and global impacts among food systems.

Tackling food waste prevention presents many cultural and political challenges. Individuals in the United States rarely want to be told what to do in their personal lives, nor do they respond well to guilt and negativity. Additionally, the national food industry has developed into a wasteful system, in which squandering food promotes profit (explained in the section *Current Incentives Promote Waste*). Changing the system requires political involvement and major policy revision. Though challenges persist, mitigating food waste is a crucial component in fixing the broken food system. Attention to food waste encourages a culture mindful about all aspects of what we eat. Pollan explains that the United States food movement is "unified as yet by littler more than the recognition that industrial food production is in need of reform because its

social/environmental/public health/animal welfare/gastronomic costs are too high" (Pollan, 2010). This paper will demonstrate that food waste plays a pivotal role in the food reformation and revolution.

The Food Movement Rises

An overarching food movement has risen in the past 40 years, recognizing that eating is an ethical act. Up until the 1970s, food had virtually vanished as a political issue on the federal agenda. A combination of cheap prices and food accessibility caused the disappearance of issues surrounding food, to both the government and general public. Culturally, the United States has valued food for three reasons, taste, price and convenience. However, values have grown beyond these three aspects. In the late 1900s, norms shifted to appreciate nutritional content of food as well (Stewart, Blisard, Jolliffe, n.d.). At the turn of the 20th century, multiple seminal events raised attention to food safety, awareness about environmental impact grew, and people began to question the outcomes of the industrial food system. As concern grew and values shifted among some United States citizens, the national food movement emerged.

The social, environmental and political costs caused by the food industry continue to gradually surface. The general United States public is responding by initiating and participating in various movements. Michael Pollan (2012) explains the overarching food movement by slicing it into individual campaigns (Pollan, 2010). Contrary to other movements, the food movement began in fragments. The campaigns can be divided into three categories of concern: social, health and environmental. Some fall under multiple categories. The reformation of the farm bill, for instance, includes environmental concern about the future of sustainable agriculture and social concern

about the accessibility of healthy food for for people of lower socioeconomic status. The campaigns are listed under the following three categories.

Social concern:

- support for local lunch reform
- animal rights
- support for student food organizations
- incentive to establish cooking and gardening classes in school
- farm worker rights
- food sovereignty: a community's right to control policy regarding food production, trade and consumption.

Health concern:

- the fight against obesity and type 2 diabetes
- regulation of food safety
- promotion of urban farming and community access to healthy food
- nutritional labeling
- regulation of ingredients and food marketing

Environmental concern:

- opposition to genetically modified crops
- the upward trend of organic and locally produced food
- reformation of the Farm Bill
- preserving farmland
- feedlot pollution

While these fragmented movements build on each other, some of their outcomes clash. The movements addressing environmental concern, for instance, have been accused of being an “elitist plot” (Bittman, 2011). Elitism refers to an attitude in which the “elite” are only concerned with benefiting their social class. In the food system, movements are considered elitist when proposed solutions are offered only to those that can geographically access and financially afford them. There is some truth to this, as local and organic food prices are higher than imported, inorganic products. However, high prices are not caused by an elitist plot. Rather, they result from current economic operations, such as economies of scale, honest prices and labeling.

Economies of scale, defined as increased product output resulting in cost advantage, causes a clash between socioeconomic classes within the food movement (Mankiw, 2014). Genetic modification and chemical fertilizers and pesticides increase quantity of output. By spreading costs out over many goods, total average cost decreases, allowing for lower unit prices (Mankiw, 2014). This process results in monocropping or monoculture, the agriculture practice of continuously growing a single crop in a particular region. Because small-scale farmers do not benefit from economies of scale, they make a profit by growing crops with a higher marginal price (e.g. vegetables with a unique season).

Alongside economic structures, other aspects of the food market inflict higher prices. Local food prices are more likely to reflect true monetary costs, otherwise called honest food prices, in which everyone involved with food production, transportation and retailing is compensated fairly. In a global food system, food producers make decisions from a distance, resulting in lack of awareness or concern. When labor to

produce food occurs half way across the world, the true costs are more easily hidden. Thus, the local movement aims to alleviate social costs (e.g. child labor) caused by a demand for cheap food. Additionally, organic food prices include the fee of sustainable labeling, such as the 'USDA Organic' marker. The local food movement encourages a strong community by connecting consumers to the origin of their food that is cultivated by farmers on nearby land. Although the environmental food movement imposes higher priced food via local and organic products, it prevents some complex problems caused by the United States free market economy, such as the outcome of economies of scale.

A case study in Santa Barbara, California explains the elitist accusation and exemplifies the broken food system, which can be fixed only in part by the local food movement. The region grows more than 50 types of vegetables and 25 fruits, houses livestock and brews wine from locally harvested grapes (Estabrook, 2011). Santa Barbara County is classified in the top one percent "of American counties for agricultural production, with annual sales of $1.2 billion" (Estabrook, 2011). Despite its abundant provision of diverse and delicious food, almost 40 percent of households within the county are food insecure (Estabrook, 2011). Food insecurity means household members do not have access at all times to food that sustains healthy lives (USDA, 2016b).

Ironically, the county imports 95 percent of the fruits and vegetables consumed within its boundaries and exports 99 percent of the nutritious food it grows (Estabrook, 2011). Therefore, only one percent of the 425,000 residents have access to the high quality products and diverse nutrients that stay within the county for consumption. Presumably, those who can access the leftover one percent of local food must have the

financial stability to do so. Due to dramatic importation rates in one of the nation's most fertile regions, Santa Barbara county exemplifies the broken food system. Despite the fertility of the region's land, nearly half its population is food insecure. Overall, the case study exemplifies the broken food system and how movements, which sometimes clash, attempt to implement changes.

So how does the elitist accusation of the food movement fit into the greater puzzle of advancing stronger food distribution, enhancing health in this country and reducing food waste? The sections *An All-Encompassing Movement* explains how the food waste prevention movement brings attention to health and food insecurity. The section *Culture of Abundance* explains how food waste prevention is related to cheap food. The section *Honest Food Prices* forms a connection between food waste and true costs.

It is true the local and organic food movement has an "elitist" trend because higher costs maintain quality and smaller scale. It is a great irony that to eat nutritionally like the former peasant class rather than packaged or fast food, has become the domain of wealthier Westerners. Nonetheless, the food movements are generally coherent. The environmental movement, for instance, links many food movements together through the common interest of reducing climate change and improving environmental conditions. Pollan clarifies, "It will be difficult if not impossible to address the issue of climate change without reforming the food system" (Pollan, 2010). Sustainable agriculture is a central focus in the collaboration between food and the environment because it lessens the impacts of climate change and other environmental issues, while also providing healthier food (Pollan, 2010). Finally, by improving worker

conditions, rural communities and human health, sustainable agriculture addresses the stewardship of humans alongside the environment (UC Davis, n.d.). This combination helps to define the interlinked movement of environmental concern and food justice, a relationship the overarching food waste movement addresses.

All-Encompassing Food Movement

Increasing awareness and concern about the issue of food waste has encouraged prevention. Mitigating food waste is developing into a movement that encompasses the core social, health and environmental components of the overarching food movement (see pg. 4). In the United States, we are often alienated from the origin of food, as we are from nearly all of the goods we consume. The result is a dangerous disconnect from the social, political and environmental problems created by the food industry and the consumers that support the industry. Food waste epitomizes that alienation. By wasting food, consumers and retailers are not just wasting the product itself, but also everything that it took to bring the product from the farm, to our plates, to landfills. Reducing food waste encourages U.S. citizens to become more in tune with the full costs associated with the production and disposal of food. Attention to food waste also prompts an understanding about the sources of individual food products and prepared meals.

With the United States wasting at least 40 percent of food produced for human consumption (Buzby et al., 2014), food waste exacerbates the issues the larger food movement attempts to address. The large amount of waste implies that U.S. culture lacks a deep understanding of the process leading up to our plated meals. We are not intrinsically wasteful nor frugal, but our disassociation prompts industry and market forces to misguide us into wasting. Mounds of perfectly edible but imperfect-appearing

peaches discarded at the farm, as well as bountiful plate waste at buffet style restaurants, illustrate a culture and economy that accepts and incentivizes food waste. Furthermore, “there is a fantastic amount of slack in the world’s food supply, where efficiency measures could create enormous savings, help fight against hunger and guarantee food for future generations” (Stuart, 2009, p. xix). By mitigating food waste, the global food system can operate more efficiently and thereby diminish the environmental and social impacts of production that food movements attempt to reduce.

The movement to prevent food waste also provides an opportunity to deter the overarching food movement away from an individualistic approach. Thus far, the campaigns regarding social, health and environmental concerns have been highly individualized in the United States. The result is “Individualism of Responsibility,” a term coined by Maniates (2002), which explains the general response to environmental issues. The concept explains that U.S. culture and industries often place solutions into the hands of individuals, which poses multiple problems (Maniates, 2002). First, individual behavior has the ability to aggravate other environmental issues. For example, “diligent recyclers expend far more fossil-fuel energy on the hot water spent to meticulously clean a tin can than is saved by its recycling” (Maniates, 2002, p.55). Furthermore, an individualistic approach understands environmental issues as “the product of individual shortcomings” (Maniates, 2002, p.45). In reality, environmental outcomes are spurred from entire industries, cultural norms and market structures. For instance, economies of scale are economic operations that cause environmental damages by limiting support for sustainable agriculture by heightening organic food prices. Individualism of responsibility also “characterizes environmental impacts as the

consequence of consumer choice," allowing consumers to "solve" environmental problems by purchasing green products (Maniates, 2002, p.47). The result is '*green washing*, the behavior of companies that claim to be sustainable through advertisements and marketing but fail to undertake business models that reduce environmental problems. Although food campaigns have good intentions, they often succumb to Individualism of Responsibility.

The food waste prevention movement deviates from this individualistic approach and towards a systematic approach. Because food waste is a deeply rooted in the United States food system, addressing the issue requires a redevelopment of the national food system. The negative outcomes of food waste (explored in the section *Consequences of Food Waste*) are vast and complex, and the solution must match the scale of consequences. The food waste prevention movement encompasses the overarching food movement because its success depends upon a systematic approach that reconnects people to the origin of food.

The food waste prevention movement encompasses concerns surrounding health by encouraging U.S. citizens to form a stronger relationship with food. In this way, it addresses health concerns that the greater food movement tackles. The first step to encourage healthy food consumptive patters is to raise awareness. The food waste prevention movement does just that. To encourage mitigating food waste, campaigns and policies can increase awareness about the environmental costs of food waste. This connects people to the origin of food they consume and educates them about their meal ingredients. Attention to ingredients and food production processes educates people, the first step to a culture that has a strong and healthy connection to food.

The final reason food waste prevention encompasses the overarching food movement is its relevance to all socioeconomic classes. Unlike some outcomes of the environmental food movement, mitigating food waste is not isolated to the elite. The beauty of reducing food waste is that everyone, no matter their status, has the ability to reduce waste. Everyone, no matter their socioeconomic class, can save money by reducing household food waste. Additionally, the food waste prevention movement caters towards food justice. By encouraging U.S. culture to form a deeper connection with food, the true costs of food production are reveled, providing incentive to lift social costs (e.g. unfair labor wages for farmers). In thinking twice about wasting food, individuals and industries are considering the environmental, social and health concerns surrounding food waste. Overall, the food waste prevention movement is all-encompassing because it reforms cultural values and norms, takes a systematic approach, applies to all socioeconomic classes and addresses environmental, social and health concerns that the greater food movement attempts to reduce.

The Consequences of Food Waste

Environmental Framework

From references to food waste in the Bible to current articles and reports, food waste is frequently framed as an ethical issue. A quick online search of food waste revels a list of sources with the common opening statistic that the amount of food wasted by MDCs is enough to feed the undernourished global population of 870 million (Gardiner, 2014). While this statistic is staggering, the reality of redirecting food out of trash bins and into the mouths of the hungry is not as simple as articles often imply. Additionally, economic incentives exist to encourage waste and many people benefit from the convenience of wasting food (see section *Current Incentives Promote Waste*). That being said, food waste as an ethical issue is a legitimate concern. The fact remains that rich countries recklessly waste food while food poverty and scarcity persists in the world.

This section sets the foundation for a framework that views food waste as a comprehensible issue by framing food waste as an environmental issue. Frameworks that solely focus on ethics have the capacity to cause individuals ignore the problem at hand rather than deal with the guilt. With regards to food waste, articles seem to imply that individuals who squander food are causing malnourishment around the globe. In reality, food waste prevention requires systematic changes alongside changes in individual behavior, as explained earlier.

This paper will primarily frame food waste as an environmental issue to bring to the forefront the scale and complexity of food waste to situate the proposed solutions.

The purpose of framing food waste through an environmental lens is to show that mitigating one third of food waste is proportional to mitigating one third of the environmental issues caused by the food industry. Unlike redistributing wasted food to those in need, preventing environmental problems caused by food waste is a comprehensible solution the general public can fully grasp.

Environmental Impacts of Food Waste

Food waste and environmental damages are overlapping issues. Environmental impacts caused by agriculture and agriculture-related practices are exacerbated by food waste. Squandering resources to produce uneaten food inflicts undue pressure on an environment already pressed to produce food for a growing population with increasing prosperity. Thus, reducing food waste simultaneously tackles related environmental damages. Framing food waste as an environmental issue reveals the resources wasted along the entire food chain, in production, processing, transportation, retailing and disposal (Stuart, 2009). Pairing the two issues looks beyond what we can see towards a larger, interconnected global system of food production, waste, and environmental damage.

The scale of wasted environmental resources matches the large scale of food waste in the United States, which some estimates show is equal to 50 percent of produced food (Stuart, 2009). The Food and Agriculture Organization of the United Nations outlines major environmental impacts: energy emissions, water scarcity, and land use. An FAO report titled *Food Wastage Footprint*, (2013) estimates that global food waste "ranks as the third top [GHG] emitter after USA and China," the amount of water embedded in food waste translates to "three times the volume of Lake Geneva,"

and the production of uneaten food uses “30 percent of the world’s agricultural land” (FAO, 2013, p.6). The following sections describe four major environmental impacts of food waste. The first environmental impact of food waste is fossil fuel emissions. The second is land deforestation. The third impact is increasing pressure the limited freshwater supply (Hall, Guo, Dore, Chow, 2009). The final environmental impact is landfill pollution caused by food waste disposal.

The first severe and widespread environmental impact triggered by food waste is energy emissions and its relation to climate change. The energy embedded in food production, transportation, processing and retailing categorizes food waste as a mass consumer of fossil fuel energy and contributor to climate change (Cuellar, 2010). New technologies, access to cheap energy, and the development of pesticides, fertilizers and resilient crops may have initially fueled a productive and successful agriculture industry able to produce groundbreaking yields (Cuellar, 2010). However, in its wake, the industry thrives on cheap fossil fuels whose production and use destroy and diminish the environment that agriculture depends upon. The FAO report shows that the United States induces 10 percent of the global food waste’s carbon footprint (FAO, 2013). Partially due to these emissions, agriculture in the United States faces “detrimental effects” including climactic extremes that shift production growth and yield while increasing insects, diseases, and weed control costs, livestock heat stress, and limited water availability (USDA, n.d.*a*). As an energy intensive industry, the global food system is pressed to mitigate food waste. The results will aid the industry in complying with environmental standards, such as emission abatement. Overall, reducing food

waste allows the agriculture industry to revive up to one third of the land it depends upon.

Stuart (2009) highlights land damage caused by food waste, stating, “Energy alone maketh not food—you also need land…among other things” (Stuart, 2009, p.89). An aerial image of the earth depicts land use where fields stretch far and wide, replacing natural landscapes to grow crops and raise livestock (Stuart, 2009). Soy, for example, is a commodity crop that requires vast stretches of deforested land to yield large quantities demanded by industrialized nations (Gardiner, 2014). In the United States and other MDCs, the predominant use of the crop is for livestock feed, in which soy is the primary ingredient. This soy-based feed is used to produce meat as well as dairy products (e.g. milk or cheese), the most wasted food group by retailers and consumers in the United States (Buzby et al., 2014). Deforestation caused by soy production is one of the many ways food waste is changing land usage around the globe. In the fragile ecosystem of the Amazon rainforest, 25 million hectares are used to produce soy. Among this land, 80 percent of harvested soy is used to make animal feed (Yale School of Forestry & Environmental Studies, 2016).

Perhaps the most staggering statistic is that of wasted water. One quarter of the national agricultural freshwater supply is consumed by food waste (Hall et al., 2009). In the United States, agriculture devours 70 percent of the total freshwater supply. Consequently, food waste consumes 18 percent of the country’s total supply, which squeezes an already limited stock (Hall et al., 2009). For example, wasting corn causes unnecessary water depletion. Corn is a commodity crop with an average global water footprint of 1220 liters/kg (Water Footprint Council, n.d.). Collectively, fruits and

vegetables account for 33 percent of the food wasted by consumers and retailers, which means we may assume around one third of corn is wasted. However, corn falls into other food categories as well. It is a unique crop because it is utilized in multiple goods: ethanol, livestock feed, high fructose corn syrup, starch, cereal, flour, sweeteners, and alcohol (USDA, 2016a). These highly demanded products process and refine corn and convert it into a primary ingredient. When these products are wasted, so is the corn and water embedded in them.

Following the depletion of land, water and energy, food waste is disposed in landfills and contributes to methane emissions. Food waste is the largest category of solid waste sent to landfills, accounting for 21 percent (Buzby et al., 2014). Landfills are surrounded by a sealed barrier and prevent waste from coming in contact with soil and air. In this environment, anaerobic bacteria degrade food waste and produce methane, an anthropogenic greenhouse gas (GHG). The GHG is anthropogenic, or human-caused because "degradation would not result in CH4 emissions if not for deposition in landfills" (EPA, 2015, p.79). Landfills account for 34 percent of human-caused methane emissions, a GHG 23 more times potent than carbon dioxide, the leading GHG contributor to climate change (US Composting Council, n.d.). Additionally, as water filters gradually through landfills it dissolves food waste into leachate. When landfills are not properly maintained, leachate leaks out and pollutes nearby groundwater (EPA, 2015). Therefore, preventing food waste has the ability to mitigate human-caused carbon dioxide emissions and leachate pollution.

Tackling the issue of food waste addresses the expansive environmental issues caused by agriculture and agriculture-related activities. To rejuvenate the environment

from these negative impacts, primarily energy emissions, water usage, deforestation and landfill pollution, the United States needs to mitigate food waste (Stuart, 2009). Framing food waste as environmental issue illustrates the severity of the problem, links it to a global community and outlines the complexity of the food chain, from seed to plate to trash. The following section describes the relationship between environmental and economic incentives and solutions. Outlining food waste as an environmental and economic issue breaks the issue into smaller parts, presenting food waste as a solvable problem.

Economic Issue

The purpose of framing food waste as an economic issue revolves around two points: the first emphasizes the need to raise awareness about the current monetary losses caused by food waste, and the second point explains the economic costs of food waste that are not reflected in the current United States market. Applying the study of economics offers a more comprehensive approach to food waste because it specifies both the social and private costs. Thus, economic application optimizes food waste solutions. Beginning with the costs of food waste is the best place to start an economic application to the problem.

Internal costs are those reflected in market prices and external costs are those not reflected in current prices. Both internal and external costs make up the losses incurred by food waste. The internal costs of wasting food are revealed through the loss of monetary value embedded in food waste. Both external and internal costs are facets within the total cost of food waste. Once the total costs of food waste are realized by accounting for each type of cost, preventative action motivated through monetary

incentives can help prevent food waste from occurring in the first place. Thus, the final purpose of framing food waste through an economic lens is to set up a system of incentives. This system is explained in the sections *Current Incentives Promote Waste* and *Incentives for Change*, which explore why food is wasted and how that information can be used to incentivize prevention. Understanding how monetary costs embed themselves into explicit costs within the market is the first step toward drafting incentives to mitigate food waste.

The internal explicit costs of food waste in the United States are determined by the average retail price of wasted food. In 2010, the monetary value of food waste at the retail and consumer levels was equal to $161.6 billion (Buzby et al., 2014). With the United States GDP worth 15 trillion in 2010, the lost value of food was equivalent to 1.2 percent of the GDP (The World Bank, 2016). The loss equals $522 per capita per year at 2010 retail prices (Buzby et al., 2014). Although "it is important to note that the value of food loss estimated…is for one snapshot in time and would change as retail prices change in response to supply and demand," this snapshot of 2010 depicts a general idea of retail value (Buzby et al., 2014, p.7). More importantly, this estimate comes from a USDA report that excludes the cost of food waste at the farm level. Thus, the true monetary value of the internal loss embedded in food waste within the *entire* U.S. food industry has yet to be determined.

Due to the fact that food waste imposes economic costs, the movement to prevent food waste can strengthen the economy by saving lost monetary value. Mitigating food waste between 20 to 50 percent could save the global world economy $300 billion (WRAP, 2015). The United Kingdom organization, WRAP, implemented a

national food waste awareness campaign, Love Food Hate Waste, which resulted in economic gains. Between 2007 and 2012, the campaign encouraged household food waste reduction by 21 percent. This figure equates to 13 billion euro (WRAP, 2015). The campaign exemplifies the economic success of food waste prevention in more developed countries. The economic outcome of Love Food Hate Waste is particularly applicable to the United States, a country with food waste figures and food consumptive patterns similar to those of the United Kingdom. The monetary value reflected in the current food market provides incentive for the United States to follow suit and prevent food waste.

In addition to market costs, food waste imposes external costs, those that are not reflected in retail prices. External costs include the "lost opportunity cost of resources wasted" (Buzby et al., 2014, p.7). Take water, for example, which is a scarce global resource. The water embedded in national food waste is equivalent to the household water needs of 500 million people (Rustemeyer & Baldwin, 2014). A business as usual approach to water markets includes wasting one quarter of the U.S. water supply to produce uneaten food. This approach will result in a demand that quickly surpasses supply by the mid 21st century.

As water reserves become depleted and supply continues to dwindle, there is great incentive to eliminate inefficient uses of water to shift supply to meet demand. Using water to produce food that is never eaten is a crucial inefficiency because it is preventable. Reducing wasted water by mitigating food waste will allow the global supply of water to increase by redistributing water to those in need. Economies will save water costs by allocating wasted water to households that increasingly demand the

scarce resource. Globally, preventing the 45 trillion gallons of water embedded in worldwide food waste will improve water market efficiency by ensuring that the limited supply it utilized at its true economic efficiency.

Other external costs caused by food waste have not yet been valued or are difficult to assign a monetary value. The devaluation of food, for example, occurs when food produced for human consumption is redirected to another use with a lower value than originally intended. Food produced for humans can instead be utilized for other products, mainly livestock feed and biofuel (Buzby, 2014). The devaluation of food, however, has not yet been assigned a value. Thus, it is difficult to assign the true cost of food waste without monetary value, which provides a common united form of measurement. Furthermore, there is a challenge in translating social costs into monetary value. For instance, food waste-induced methane emissions impose social costs by elevating climate change. These costs, including sea level rise and an increase in average global temperature, impact individuals and communities at different levels of severity. While many MDCs have powerful economies to mitigate the impact of climate change, LDCs will face higher social costs. Overall, assigning monetary values to the costs of food waste is often complex, instigating a challenge in reflecting the true costs of food waste through market prices.

Despite lack of monetary values, economists have ways of reflecting negative costs into the market. Economics utilizes market instruments (e.g. tax) to internalize negative externalities and reflect external costs in market prices. Negative externalities are “transaction costs that spill over from an action (e.g. food production or disposal) that can adversely affect society and the environment and that are not incorporated in

market prices (e.g. the price of food)" (Buzby et al., 2014, p.3). The purpose of internalizing the negative externalities that food waste imposes is to provide economic incentive to change the United States food system by mitigating waste.

In the effort to reduce food waste and internalize the associated costs, prevention is a more effective approach than disposal. Fortunately, these two approaches are linked; "as the first challenge is met more fully, the second becomes less of an issue" (Buzby et al., 2014, p.7). Prevention is more economically efficient because it addresses the costs and benefits along the entire food chain, from farm to plate. Attempting to deal with the cost of food waste once it has already been discarded is economically inefficient and provides little to no incentive for the system to change. For instance, "if uneaten food is simply diverted to other economic uses beyond human consumption (e.g., animal feed or energy generation) so that domestic demand for food and domestic food production remains roughly the same," the "food industry's business will remain roughly unchanged" (Buzby et al., 2014, p.7). An unchanged industry will continue to waste between 30 and 40 percent of food that is intended for human consumption as it has no incentive to alter its behavior or producing methods. Here, economic analysis of the issue reveals a solvable problem. The goal is not to induce guilt, but to raise awareness by explaining to people "they are [probably] wasting more food than they think" (Gardiner, 2014). By providing economic incentive and information about the problem, the infiltration of food waste among the entire food system can be reduced and prevented.

Figure 1

The Environmental Protection Agency (EPA) has established a Food Recovery Hierarchy that prioritizes actions to mitigate food waste. Each tier highlights a different management strategy. Source reduction, the most necessary strategy, aligns with preventative management. Composting and landfill disposal methods, the least desirable strategy, are the approaches to disposal management. The EPA's hierarchy demonstrates the federal department's emphasis on prevention methods instead of disposal methods to tackle the issue of food waste. The EPA confirms that prevention is more effective than disposal. The EPA hierarchy also represents the multiple industries (e.g. waste management for disposal and retail management for feeding the hungry) involved with mitigating food waste on a systematic level (EPA, 2016).

Finally, framing food waste through an economic lens provides current economic incentives to mitigate food waste. However, economics also aims to understand people's behavior as well as the relationship between producers and consumers. Again, humans are neither intrinsically frugal nor wasteful. Rather, people have economic, cultural, and personal reasons to waste food. Thus, the economic section establishes a foundation for the section *Current Incentives Promote Waste*, which outlines the incentives for food waste among the farm, retail, and consumer levels.

Current Incentives Promote Food Waste

The purpose of this section is to evaluate why food waste prevails in the United States despite the environmental and economic incentives to mitigate waste. Deep-rooted cultural, economic and personal incentives promote waste. Although the USDA report (2014) claims that "some food loss is inevitable," understanding and analyzing the root causes of food waste establishes the issue as avoidable and preventable (Buzby et al., 2014, p.4). As Stuart (2009) explains, "Before we try to imagine possible solutions to the problem of food waste, is is vital to understand the reasons behind people's behavior" (Stuart, 2009, p.73). Behavior surrounding food waste occurs at the farm, in retail stores and as individual consumers. These levels operate within a cohesive national and global food system. The incentives that promote waste are instilled throughout the entire system; they overlap and influence each other.

Figure 2 depicts a list of direct reasons why food is wasted at and between the farm, retail and consumer levels. By displaying the surface-level reasons why food waste occurs in the United States, the list lays the foundation to explore these deep-rooted incentives, which are instilled in economic structures, personal awareness and knowledge, lifestyle conveniences, financial benefits and cultural values and norms. The following sections explain in detail the most significant incentives that currently promote waste. The explanation begins with a predominant cultural incentive that promotes waste and breaks off into the three levels at which food waste transpires.

Causes of Food Loss and Waste at the Farm, Farm-to-Retail, Retail, and Consumer Levels

(Farm Level (not measured in this report)

- Consumption or damage by insects, rodents, birds, or microbes (e.g., molds, bacteria),[a] and damage by unfavorable or extreme weather (e.g., droughts, floods, hurricanes, and freezes).
- Diminishing returns when harvesting additional increments of production and other factors leading to leaving some edible crops unharvested.
- Overplanting or overpreparing due to difficulty predicting number of buyers/customers.

Farm-to-Retail Level (not measured in this report)

- Rejection of some products for human consumption due to industry or government food safety regulations or standards (e.g., livestock condemned at slaughter for food safety reasons).
- Byproducts from food processing landfilled or incinerated (i.e., not diverted to other food uses such as for ingredients in mixed foods).
- Outgrading of blemished, misshapen, or wrong-sized foods due to minimum quality standards by buyers, which are the result of consumer demand for high-quality, cosmetically appealing, and convenient foods.
- Spillage and damage, such as by equipment malfunction (e.g., faulty cold or cool storage) or inefficiencies during harvesting, drying, milling, transporting, or processing.

Retail Level

- Dented cans and damaged packaging. Inappropriate packaging that damages produce.[b]
- Unpurchased holiday foods.
- Spillages, abrasion, bruising, excessive trimming, excessive or insufficient heat, inadequate storage, technical malfunction.[a]
- Overstocking or overpreparing due to difficulty predicting number of customers.
- Culling blemished, misshapen, or wrong-sized foods in an attempt to meet consumer demand.

Consumer Level

- Spillages, abrasion, bruising, excessive trimming, excessive or insufficient heat, inadequate storage, technical malfunction.[a]
- Sprouting of grains and tubers, biological aging in fruit.[a]
- Consumers becoming confused over "use-by" and "best before" dates so that food is discarded while still safe to eat.[b]
- Lack of knowledge about preparation and appropriate portion sizes. For example, lack of consumer knowledge of when a papaya is ripe, how to prepare it, and how to use it as an ingredient are reasons for high papaya loss.[c]
- Industry or government standards may cause some products to be rejected for human consumption (e.g., plate waste can't be re-used at restaurants).
- Psychological tastes, attitudes, and preferences leading to plate waste/scrapings (e.g., human aversion, such as "I don't eat that," or refusal to eat a food for religious reasons).[a] Consumer demand for high cosmetic standards.
- Seasonal factors: more food is wasted in summer.[d]
- Uneaten or leftover holiday foods.

Sources: [a] Zeigler and Floros (2011), [b]Parfitt et al. (2010), [c]Buzby et al. (2009), and [d]Gallo (1980), and the remainder was constructed by the authors, 2012. A previous version of this table was published in Buzby and Hyman (2012). Some of these examples of causes may occur at more than one level (e.g., spillage).

Figure 2

(Buzby et al., 2014, p.5)

Culture of Productivity and Abundance

A culture of productivity and abundance is embedded in the general public of the United States and plays a particularly crucial role in decisions and behaviors surrounding food. This culture instills value in food quantity, instead of food quality. The outcome is a nation of people that requires more than enough food grown by farms, atop restaurant plates, on grocery store shelves, and in household refrigerators (Rustemeyer & Baldwin, 2014). Placing a high value on abundance influences farmer's actions, retail management, and personal consumer behavior. A consequence of valuing food abundance instead of food quality is the obesity epidemic our nation faces. Also in a society so concerned with abundance, we often fail to see or care about the consequences of waste. In this way, food waste is deeply tied to a widespread culture of abundance. The history of how this cultural value emerged provides an understanding of how abundance is rooted in the food system and initiates the incentive to waste food on a widespread scale.

In the mid 1900s, the United States culture placed a lasting value on high productivity and the outcome was an abundance of goods, from food to cars to military weapons. Beginning in the narrative during World War II, the United States government emphasized that production in the hands of individual citizens would conquer the enemy. Citizens were given an individual responsibility to maintain a powerful country, which succeeded in achieving full employment. Due to limited resource production, Germany and Japan were defeated by the United States and its allies (Bothun, 2015). The United States citizenry in the 1940s was ripe for a renewed belief in U.S. strength and power, given the hardships of the preceding decade. Coming out of the Great

Depression of 1929-39, it is perhaps understandable and even laudable that Americans believed that hard work and self-sacrifice could erase the scarcity, poverty and hunger of the depression era. Having enough food to waste, like littering, was a sign of providing for one's family of affluence.

Post WWII, production continued to increase as did the mentality that individuals could solve global conflicts. The 1950s brought forth advertisement and marketing, which further encouraged a rise in production and consumption (Bothun, 2015). With a seemingly endless supply of goods, a culture that demanded and expected abundance surfaced in the United States. Fed by economic theories of capitalism and a free market economy, people increasingly began to equate their well-being with more of everything—more clothes, furniture, electronics and more food (Bothun, 2015). Contrary to other countries, the United States has tended to equate abundance with status and worthiness, rather than bloodlines or even talent. In the U.S., it had become to be seen as a value to have a great quantity of foods, including food, often over quality. And thus, for many reasons, the age of consumption was born (Bothun, 2015).

The age of consumption impacts the food industry by generating a system that incentivizes mass food production and encourages consumers to demand large quantities. Another significant outcome of increased productivity is the extremely cheap price of food (Pollan, 2012). In the 1970s low prices induced stronger food security, causing food to disappear from the political agenda. With little attention to issues surrounding food production and cheap prices, food became viewed as a "disposable commodity" (Pollan, 2012). Although attention to social, environmental and health issues concerning food is growing, the view that food is a disposable commodity is a

lasting cultural norm. Because food continues to be so cheap, the convenience of having a bountiful plate of food often outweighs the price of wasting food.

In a culture that values quantity over quality and fails to see the consequences of waste, people are constantly provided incentives to waste food. When we evaluate food based on price, rather than true indicators of value such as nutritional content or eating slowly as a social or family activity, it becomes much easier to throw away without feeling a sense of guilt. The well-known cookbook *The Joy of Cooking*, represents the strong impact that the culture of abundance has on food. Although the recipes have stayed the same, the amount of individuals each portion feeds have drastically decreased in the past 30 years. While a meal may have served six people in 1975, it now serves two (Rustemeyer & Baldwin, 2014). This represents the Untied Statutes cultural norm that portion sizes should be so large that excess food remains after a meal is finished. The alternative is overeating, which has contributed to the nation's obesity epidemic. Whether it be at the dinner table, supermarket delis, buffet-style restaurants in Las Vegas, school lunches or catered meals, the United States culture has an expectation for an abundance food. So much so that the outcome is often uneaten food that ends up wasted.

Overall, a culture of abundance influences the food system by causing the United States to produce, order, purchase and cook more food than we can consume. Not only has our value system brought about an obesity epidemic in the United States, but it has also driven food waste up the food system (Royte, 2016). Because food waste is "very scattered throughout the system…it makes it hard to point a finger and it also makes it hard to see" (Rustemeyer & Baldwin, 2014, 03:07). As a result, nearly half the

food we initially sought to eat ends up wasted. To pinpoint the scattered issue and work towards a solution, incentives that promote waste are explored in the following sections.

Farm Level

The first reason food waste transpires at the farm level and is instilled in the history of government subsidies. The subsidies discussed are largely for grain and commodity crops, which provide the fundamental ingredients for many processed and packaged food products. The demand for these crops is high, and has been since industrial food processing launched in the early 1900s. Due to high demand, subsidies have transformed into permanent legislature. The history of agriculture in the United States provides insight into the development and lasting effects of subsidies.

Agriculture subsidies began as a temporary response to the Great Depression in the 1930s. As the economy crashed, the supply of food produced by farmers surpassed the amount consumers were buying. This caused prices to fall and farmers struggled to meet payments. The government intervened by setting a price floor, the legal minimum at which goods can be sold. As a part of the New Deal, the Agriculture Adjustment Act (AAA) was enacted (Masterson, 2011). The AAA required the government to purchase excess grain from farmers. In later years, when supply would drop and cause prices to rise, the grain would be released back on to the market to stabilize prices. Subsidies initially used to cushion the costs of overproduction during insecure times grew to set the stage for a federal government that provides incentive to overproduce.

Through the mid to late-1900s, agricultural policy continued to change and develop. Economic forces and government intervention varied depending on the voices and actions of Congress, the branch of government that implements national agriculture

policy. Despite steady crop prices at the turn of the 21st century, the government continued to subsidize farmers based on acreage and crop type. The four commodity crops—corn, wheat, cotton and soy—with the highest demand were highly subsidized, providing farmers incentive to produce mass amounts of those crops. With a large supply of commodity crops, the price of food containing corn, wheat and soy dropped (Masterson, 2011). As mentioned earlier, the cheap price of food encourages food waste among the entire food industry.

The crucial relationship between subsidies and food waste is the government's ability to provide a safety net for the consequences of overproduction (Stuart, 2009). Subsidies guarantee farmers receive payments when they produce too much food, which would otherwise cause lower prices or unsold goods, resulting in lower profit. Price floors also guarantee that crop prices won't drop to zero regardless of supply. These market forces mean that "farmers can still be slightly more relaxed about the financial risks of over-producing beyond demand than they might otherwise have to be" (Stuart, 2009, p.123).

The history of grain and commodity crop subsidies sets the foundation for current incentives that promote farms to waste food. This is because the agriculture industry relies on the government to establish policies to secure farmer incomes—a difficult task to do for an industry that depends on unpredictable climate—and provides a product that is necessary to sustain human life. To cater towards an industry that fluctuates year to year, Congress implements a new Farm Bill with fresh policies every five years (Masterson, 2011). The reformation of the 2016 Farm Bill eliminated subsidies based on acreage, but it continues to pay farmers when commodity prices fall,

which has been the trend since the previous Farm Bill (Charles, 2016). By continuing to provide farmers with a safety net when they overproduce, federal policies indirectly provide incentives that promote waste.

Unlike grains and processed commodity crops that can be preserved for long periods, fruits and vegetables are perishable, making surplus crops a bigger challenge. When vegetables and fruits have been grown and harvested but farmers have no financial incentive to collect the harvest and sell the product, mounds of food are discarded or left on the fields. Some farmers use the agricultural technique of plowing the excess crops back into the soil to help increase soil fertility for future growing seasons (Rustemeyer & Baldwin, 2014). However, the energy and water used to grow the food would be utilized to a much greater extent if the food reached its original intention of feeding people (Rustemeyer & Baldwin, 2014).

While agriculture policies incentivize over producing grains and commodity crops, current retail standards provide incentive for farms to waste fruits and vegetables. There standards are not lenient nor avoidable. Retail standards far exceed the federal and state standards for supermarket products (Rustemeyer & Baldwin, 2014). Farmers that grow produce for a profit must meet the demands of their buyers and when supermarkets have unrealistic demands, the crops that don't meet those requirements are often wasted. Supermarkets in the United States have high cosmetic standards and little to no demand for imperfect appearing yet perfectly edible fruits and vegetables (Royte, 2016). Because farmers don't have full control over appearance, 'ugly' and undesirable fruits and vegetables are left behind on the fields. When big-scale farmers want to donate rejected food, unsold produce is so large that charities lack the

infrastructure and capacity to take it all. They also demand products that fit into the packaging they provide, resulting in fruit and vegetable trimmings piling up on farm fields. Even when farmers want to collect and sell the trimmings, they may have monetary constraints that prevent them from hiring laborers to pick up the leftovers. Retail standards require farms to use graders that sort through the harvest and select fruits and vegetables that are not desirable enough for supermarket shelves (Rustemeyer & Baldwin).

Food waste rejected at farms and discarded immediately is thrown into nearby dumpsters and shipped off to landfills or left on farmland and used as fertilizer. Some of the excess food leaves the farm and is converted into livestock feed or biofuel and some is donated to those in need (Stuart, 2009). A portion of excess crops are converted into unhealthy ingredients, such as wheat into white flour and corn into corn syrup. These end up in the stomachs of citizens swayed by large portions to overeat, contributing to the United States obesity epidemic (Pollan, 2003). The rest of food waste leaks "out at the seams and bottlenecks in the system," trickling down the food system into the bins of retailers and consumers (Stuart, 2009, p.123).

Retail Level

Retail stores play a role in influencing farms to waste food and they also waste themselves. The first reason supermarkets waste is due to lack of awareness or concern surrounding the legality of donating unsold or excess food to charities. Under the Good Samaritan Act, supermarkets cannot be held liable for donating food that may cause health concerns. The federal act states, "A person or gleaner shall not be subject to civil or criminal liability arising from the nature, age, packaging, or condition of apparently

wholesome food or an apparently fit grocery product that the person or gleaner donates in good faith to a nonprofit organization for ultimate distribution to needy individuals" (Good Samaritan Food Donation Act, 1996). Despite this act, supermarkets continue to use the legality excuse to avoid dealing with the presumed inconvenience of delivering unsold food to charities (Rustemeyer & Baldwin, 2014).

Financial incentives also promote retail stores to waste food. Retail stores will waste food if the costs of mitigating waste exceed the benefits. As the national food waste prevention movement grows, retailers will benefit from mitigating waste to gain positive public relations. Currently, however, retailers profit margins incentivize them to overstock and waste food (Stuart, 2009). For example, "a food company may weigh the costs of switching to more expensive packaging for fresh meat against the benefits of having that packaging extend the shelf life of the meat" (Buzby et al., 2014, p.8).

Often, the benefits of wasting food have nothing to do with monetary value. Instead, some benefits are simply due to matters of convenience. Assigning an employee to redistribute unsold food to charities requires time and payment. More importantly, any true solution requires that supermarket monitor food waste. When food waste is out of sight, it is out of the retail manager's mind. If supermarket managers are not directly connected to the issue and fail to see it with their own eyes, they form a disconnect and build further incentives to promote waste. Convenience is a major incentive that promotes food waste at the retail level. Ultimately, retailers have to care, whether because of public relations, monetary reasons, environmental awareness, government regulation or good business practices.

Supermarkets are also constrained by inefficient management strategies caused by a culture of abundance. Retail management "operate[s] under the assumption that customers buy more from brimming, fully stocked displays, preferring to choose their apples from a towering pile rather than from a scantly filled bin" (Gunders, 2012, p.10). In an example from the documentary Just Eat It (2014), a farmer explains that the last item on a shelf will rarely be sold. Consumers have an irrational fear there is something wrong with the product because it hasn't been bought yet (Rustemeyer & Baldwin, 2014). Managers understand this consumer behavior and overstock shelves in fear of losing purchases. However, in an effort to please customers, supermarkets overstock their shelves and end up throwing out food. Ultimately, retailers value their image and customer approval over the losses associated with wasting food. Supermarkets also "refuse to stock small portions, which are essential for the growing number of one person households, and offer too many BOGOF deals on perishable goods" (Poulter, 2008). Overstocking of any kind leads to an increase of food waste. Either the goods expire or decrease in quantity before they are bought, or are taken off the shelves to rotate products.

Finally, supermarkets are constrained by lack of cooperation and communication with farms and consumers. Manufacturers receive products from farms, place them into cases and distribute them to supermarkets (Staurt, 2009). Retailers don't have the flexibility to determine case sizes and would rather have more products than not enough. They purchase more than their shelves can hold and the rest is thrown out (Gunders, 2012). Another miscommunication is between consumers and retailers. Each year, around 19,000 new products are placed on grocery store shelves and are many

unpopular with consumers. Promotions that have passed are also undesirable to consumers. For instance, once deals on holiday food pass a certain date, there will no longer be any demand. When products fail to sell, they are discarded (Gunders, 2012).

Consumer Level

Consumer behavior is easily influenced. Discounts and deals instigate rash decisions and branding persuades that products can determine image and attitude. Consumer behavior regarding food and food waste is no exception. A supermarket's layout, image, information, deals and discounts, label dates, and emphasis on uniformity and appearance guide consumers into squandering food. Cultural values and norms about portion size and leftovers also lead people into wasting food. The many reasons that consumers waste food are not only widespread, but also condoned (Rustemeyer & Baldwin, 2012). From a general retail standpoint, over-purchasing food is encouraged. The more food a consumer purchases, the higher profit a retail business receives. Alongside retail incentives that promote waste, societal status and cultural norms influence the food a consumer will waste. Each discrete reason why consumers waste food will be further explained in the following paragraphs.

Sixty percent of consumers dispose food prematurely due to confusion over label dates (Gunders, 2012). The first is the 'sell-buy' label date. Just as the label indicates, sell-by label dates signify when the products should be sold, not the date they need to be consumed by. Sell-by dates guide retail staff as they manage stocks and shelf products. It allows them to know the last date at which the product should be sold so it is still good when consumers bring it home. To avoid confusion, consumers should entirely ignore this date (Stuart, 2009).

The other most prominent set of label dates are the ‘use-by,’ ’enjoy-by,’ ‘best-by’ or ‘guaranteed fresh-by’ labels. Consumers should see these dates, as they indicate quality (Rustemeyer & Baldwin, 2012). Here, there is confusion because this label indicates the quality of the product but not necessarily the safety (Stuart, 2009). Because of our culture’s skewed definition of food quality, food products can be perfectly edible after the date even if they don’t appear perfect. These label dates are merely retail standards, not state or federal safety standards. “The only thing required by federal law in the U.S. to have an expiration date label on it is infant formula” (Rustemeyer & Baldwin, 2012, 53:40). The true indicators of safety are our senses and other educational techniques. The quality of eggs can be tested by placing them in a glass jar of water. If the eggs float, they are no longer good to eat. Ultimately, our society is so disconnected with the origin of food we lack an intuition about the safety of food. Rather than using our senses to see if a carton of milk has gone bad or a piece of chicken is no longer safe to eat, we look to label dates that have us waste food prematurely.

Perhaps the most significant incentive that promotes consumers to waste is the culture of abundance instilled in decisions made at the grocery store and in our homes. Poor planning, including lack of shopping lists and meal preparation, causes purchased food to spoil before being used. Deal and discounts prompt consumers to purchase both products in bulk, a behavior that results in food waste (Gunders, 2012). Cultural expectations about portion sizes also encourage people to cook more than necessary and, in turn, waste leftovers. In the documentary Just Eat It (2014) a chef explains that the rule of thumb in the catering and restaurant business is to never, ever run out of food

(Rustemeyer & Baldwin, 2014). Promotions for unique products also encourage rash consumer behavior that results in food waste (Gunders, 2012). For instance, papayas are the most wasted produce in the United States due to lack of familiarity on how to prepare them, when they are ripe, and how to use them as ingredients (Buzby et al., 2009). The papaya fruit, which consumers gravitate to for their uniquely tropical charisma, are a prime example of how consumer behavior is influenced by the abundance of food options in the United States.

Incentives for Change

Understanding current incentives that promote waste prompts a growth in awareness and encourages the development of a food waste prevention movement. Framed through an environmental and economic lens, this movement has the ability to influence political actors, supermarkets, restaurants and individuals to reform the food system by addressing the issue of food waste. Environmental and economic consequences of food waste and challenges to cultural values and norms instigate concern. However, to be successful on a large-scale and contribute to the reformation of the food system, the food waste prevention movement requires a systematic approach in which world leaders and every day citizens develop concern about the consequences of food waste. The following section helps instigate that concern and calls for global pressure on the United States and other MDCs to mitigate food waste.

Improving Food System Efficiency

As world population grows, affluence expands and urbanization increases, the food industry faces a global increase in demand. Some scholars and industries suggest that food production must increase by 70 to 100 percent by 2050 (Royte, 2016). The food industry is an energy and resource intensive system; doubling productivity will drastically damage land and deplete resources that our planet depends upon. Additionally, urbanization and emerging economies influence tastes for dairy and meat, products that require particularly large amounts of energy, land and water. The amount of water needed to make a single hamburger patty is equivalent to taking a 16-hour long

shower (Rustemeyer & Baldwin, 2012). World leaders face a dilemma on how to feed the population without depleting environmental resources that sustain humanity.

Food waste prevention provides an approach to meet a growing demand by eliminating inefficient uses of water, energy and land instead of increasing productivity and consuming a greater about of resources. Preventing food waste is a parallel to energy efficacy, another resource intensive industry that faces increasing demand with growths in population and affluence (Rustemeyer & Baldwin, 2014). Energy efficiency allows an increase in energy use without increasing energy production, which costs a lot of money and produces harmful outputs such as carbon dioxide emissions. The same concept of energy efficiency can be applied to food systems. In the food industry, there has been an emphasis on water and fertilizer efficiency (Rustemeyer & Baldwin, 2014). Food waste, however, is a is a major inefficiency in the U.S. food industry that has received little attention thus far. Valuable resources including money and energy leak out of the food system when waste occurs. If that waste can be mitigated, the food industry can use current inputs to meet an increasing demand, without producing more food.

Governments and nations across the globe have incentive to prevent food waste. Pollan (2012) states, “In the history of civilization, food is political when there is not enough of it” (Pollan, 2012, 07:45). Thus, political leaders work to keep food issues invisible from the public. In the interest of increasing food supply to satisfy a global population expected to reach 9 to 12 billion, politicians have incentive to implement regulations and policies that reduce the inefficiency of food waste. In redistributing

food that is already being grown, nations can avoid food crises caused both by intensive food production and also food shortages.

Stuart states, “We have to use our land in a sensitive way. To plan and to manage it in a way that insures that people are fed and insures the long-term health of the ecosystems that we depend on for our survival” (Rustemeyer, 2016, 40:40). To do so, we must develop incentives that encourage efficiency over productivity. In the United States, food waste seemingly represents the greatest inefficiency in the current food industry. Providing incentives for the United States to reduce food waste will reduce environmental and economic costs domestically. On a global scale, mitigating food waste provides an effective approach to meet growing demands and feed the 1 billion people that are currently undernourished, all without increasing environmental damages and depleting valuable resources.

Honest Food Prices

Food waste reduction in the United States will have intended and unintended outcomes. It will disrupt the food system. Reducing food waste will shift the food system away from a narrow scope that focuses solely on total productivity towards more efficiency. This will relieve the environment of some agriculture-related impacts. Food waste reduction will also improve economic efficiencies for certain producers that learn how to pivot to higher quality foods. However, U.S. food waste reduction may inflict economic losses in countries and communities that have come to depend on the United States’ high demand for cheap food in large quantities. The global food system currently thrives off of such imbalances. Developed nations demand high quantities of cheap food and developing countries often face environmental damages and social costs

to produce these cheap goods. However, honest food prices have the capacity to avoid economic losses in countries that produce high quality food while simultaneously providing incentive to reduce food waste in Western nations.

Honest food prices are defined as prices that reflect the true cost of producing food, including the cost of negative externalities associated with the production of goods or services. The production of cheap food often pushes the cost downstream to social and environmental costs, from unfair wages to environmentally destructive agriculture practices. Besides products with eco-labeling, such as the 'fair trade' marker, true costs are not currently reflected in many imported food products. There is a reason why we pay such a low price for tomatoes from Mexico and palm oil from Indonesia. Honest food prices can reduce food waste in two ways. First, they make wasting food unaffordable to industries and individuals is in the United States. Second, honest food prices make it sustainable for farmers around the globe to be fairly compensated to produce higher quality food in smaller amounts, which eliminates desperate overproduction.

Implementing Change

As the food movement rises and gains momentum, incentives for change within the food system emerge. As Stuart (2009) states, "Food is not just a commodity but a vital interface between people and the earth" (Stuart, 2009, p.288). If the United States culture recognize this, a systematic approach driven by changes in culture will work to reduce food waste and play a key role in reforming the food system. A systematic approach includes addressing food waste on all levels. It allows politicians, environmentalists, economists, lawyers, farmers, activists, chefs, business owners and

every day consumers to tackle the issue as a coherent group. Alternatively, smaller groups of interested and engaged stakeholders can form to identify issues, problems and potential solutions within their areas of expertise. They can then help with outreach to the constituents and areas of influence. Effectuating change often takes reaching a small but increasingly critical mass. Seeking to embed different ways of doing business as a part of organizational cultures and everyday citizens purchasing habits also instigate change. Awareness is the first step, followed by action plans.

Retailers sit in the middle of the food chain and are “in a useful position” to greatly influence suppliers and consumers (Gardiner, 2014). To limit food waste on the retail and farm level, while also influencing consumer behavior, grocery stores can provide bargain shelves for produce with bruises, scars, or other imperfections. They can also demand that manufacturers eliminate unnecessary label dates, only display dates to employees and/or education consumers about the label date system (Stuart, 2009). Retailers can record food waste data to target inefficiencies and focus on mitigating the most wasted food categories.

Governments can avoid farm subsidies that provide incentives to overproduce. State and federal governments can also run public awareness campaigns to educate the general public about the issues surrounding food waste and encourage them to change behavior (Stuart, 2009). Finally, they can require food companies to record and report food waste.

Restaurants can establish accurate demand forecasts to prepare the amount of food that will be ordered by customers (Stuart, 2009). By monitoring customer consumption and reducing portion sizes, they can reduce plate waste (Royte, 2016).

Restaurants can also provide different portion size options to cater towards customers that plan to eat less. Varied portion sizes with corresponding prices also allow customers to pay for the food they will actually eat. Training staff to properly manage stocks limits poor restaurant management that causes food waste. Finally, restaurants can donate excess food to charities when surplus food occurs (Stuart, 2009).

We all consume food, which means we can all mitigate food waste on an individual level. Perhaps the greatest incentive to change consumer behavior is the fact that decreasing household food waste saves money. When one third of purchased food is wasted, one third of money spent at the grocery store is flushed down the drain. Even though food is relatively cheap and the average U.S. citizen spends a mere 6.8 percent of their income on food, mitigating food waste in the long run saves a large amount (Washington State University, 2008). Reducing waste as consumers requires planning meals to avoid over-purchasing or purchasing items that will remain uneaten. Make grocery lists and stick to them to avoid being swayed by discounts and promotions on products that won't be eaten. Buy a combination of frozen, canned and fresh food to extend the lifespans of planned meals. Store leftovers for later and learn how to cook excess food scraps (Stuart, 2009). Bread crusts, for example, can be made into crunchy croutons. As consumers, demand that grocery stores provide imperfect appearing produce (Royte, 2016). Above all, place value in the quality of food rather than the quantity and encourage friends and family to do the same.

Global, National and Local Strides

Countries around the globe are taking great strides to mitigate the impacts of food waste and work towards reforming the food system. In February 2016, France

became the first country to ban supermarket food waste. The country passed a bill that requires all supermarkets to form contracts with charities, to which they will donate all leftover food products (Chrisafis, 2016). The United Kingdom organization WRAP has run a successful campaign that has reduced avoidable household food waste by 21 percent between 2007 and 2012 (WRAP, 2016b). The organization continues to collect data, compile research and formulate reports and campaigns to further reduce food waste in the UK (WRAP, 2016b) Taiwan and South Korea convert every ton of disposed food into livestock feed or compost (Stuart, 2009). Although Japan wastes almost as much as the United States, Japanese people are not wasting food by over-eating (Stuart, 2009).

On a national level, the USDA and EPA have joined together to establish to first ever national food waste reduction goal. The two departments have called for a 50 percent reduction by the year 2030. Working with charities, local, state and federal governments, the plan is to focus on reducing, recovering and recycling food waste (USDA, n.d.*b*). The first federal goal aims high and encourages food wastage monitoring and reports. It is the first step in raising awareness on a national level and implementing federal policy. The U.S. Food Waste Challenge can take further steps by establishing and implementing regulations that are legally binding.

On a local scale, farmers, grocery stores and schools are working to educate consumers about why food waste prevention matters and providing options to form a connection with food and change individual behaviors. Erica, the owner of Sweetwater farm in Eugene, Oregon, encourages community citizens to tour the farmland, providing an opportunity for consumers to connect with the origin of food.

Earlier this year, I took a quiet walk around the greenhouses on a foggy Saturday afternoon with Erika. She kindly showed me bundles of radishes, flourishing rows of chard, and sprouts of peppery arugula, encouraging me to taste food directly from the earth. The following list is how Sweetwater, a small-scale farm run by a crew of four, reduces food waste.

- Crop planning by matching supply with demand to avoid excess production.
- Timely harvesting, such as avoiding zucchini growing too big or tomato skins splitting.
- Proper post-harvest handling practices that extend shelf life and preserve quality.
- Dry, freeze or in other ways preserve summer crops for the winter season.
- Providing employees with perfectly edible produce with cosmetic damages.
- Donating wilted greens and trimmings to a nearby rabbit rescue organization.
- Using volunteers to glean at the end of seasons to salvage and donate extra produce.
- Composting the remaining produce.

Source: (E. Trappe, personal communication, February 15, 2016).

The techniques used at Sweetwater farm require time and labor that many farms do not have or do not partake in because the benefits fail to outweigh the costs. However, this detailed list shows that placing a high value on food leads to creative and practical methods that reduce waste. These techniques help local citizens and companies, which forms a community that is aware about food waste and takes actions to reduce the severity. Whether it be as farmers, store managers, politicians or consumers, all individuals have the capacity to alter behaviors. Ultimately, the techniques used at Sweetwater farm represent food waste as a solvable problem.

In Portland, Oregon the local grocery chain New Seasons places bruised and misshaped fruits in bins for children to eat free of charge. This retail strategy encourages children to form a relationship with food by placing value in taste rather than appearance. It also helps shoppers increase awareness about consumers' tendency to select produce solely based on cosmetic appearance. At the University Oregon, composting bins are placed around campus, encouraging students to eat what they buy and compost the rest. Also in Eugene, Oregon, a grocery store Sundance provides a bargain shelf for produce that is cosmetically damaged or nearing expiration. This is just one example of the 'ugly' food movement, which is mounting in practice and popularity around the United States (Royte, 2016).

My Thoughts and Personal Story

When I began the thesis process in September 2015 I did not fully anticipate that I would learn so much about food systems. Nor did I know I would form such a deep passion for the issue of food waste. Humanity's ability to produce such mass amounts of waste has always interested and frightened me. Our seemingly endless production of

waste doesn't match the earth's capacity to contain waste; it leaks from landfills and trash bins, infiltrating earth's most untouched ecosystems. Food waste, however, is an aspect of human excess and environmental impact I find solvable. Everyone eats food and wastes food and from my experience, believes food waste is a serious issue that they are eager to fix.

In my attempt to not waste a single food item the past 9 months, my knowledge about the origin of food expanded and I became more aware of food quality. I threw wilted carrots into a pot of soup and learned that boiling water puts the crunch back into old vegetables. Wilted greens become crisp after soaking in a bowl of ice water. In my effort to use an unripe avocado before leaving town so it wouldn't spoil over the weekend, I learned that placing it into the oven for ten minutes creates the softest, warmest toast spread. Reviving my produce, buying canned goods, freezing my bread and trying my best to not over-purchase, allowed me to reduce waste and save money on a college budget. Best of all, with my constant chatter about food systems, and occasionally evoking guilt along with my admittedly somewhat crazy effort to scrape up my dinner party's leftovers, I have inspired and encouraged my family and friends to follow suit. Of this I am most proud, and it gives me hope that it is possible to effectuate change, one step at a time.

My thesis' contribution to the food waste prevention movement as it emerges in the United States has been deeply fulfilling. Each time an article is published my phone lights up with messages from friends and family, excited to see that published authors care about this topic, too. To write alongside the emerging movement and watch it

unfold as my thesis evolved page by page has instilled a powerful meaning within this thesis.

Conclusion

As awareness grows about the consequences of food waste and incentives to mitigate waste arise, the food waste prevention movement emerges and strengthens across the United States. Social, health, and environmental concerns are pressuring national and international food systems to undergo a reformation. Preventing food waste addresses these concerns by establishing a cultural norm that values food quality over appearance and convenience. This awareness can create a cultural recognition of the dynamics of food production and consumption, the inefficient waste it creates, and the benefit of food waste prevention. An increasing demand for food, caused by growths in population and affluence, also require food systems to redevelop so supply can meet demand. Food waste prevention aids this redevelopment by decreasing inefficiencies in the food chain and redistributing uneaten food to those in need. Focusing on efficiency, both in production and consumption, rather than simply increasing productivity, protects the environment from further destruction inflicted b4y food production and disposal.

Until the food waste prevention movement has a clear framework, however, the issue will continue to appear scattered and unsolvable. The goal of this thesis is to help provide that clear framework to ease the challenges of mitigating food waste. First, food waste prevention was framed as an all-encompassing movement. To form an understanding before proposing solutions, this thesis explored current

incentives and cultural norms that promote food waste. It then explained how waste can be prevented or reduced by altering these incentives and norms.

This thesis establishes a framework that presents food waste as a severe issue, but one that is solvable on a systematic level. It educates the general public about food waste. Overall, this thesis encourages United States and world leaders, businessmen and women, environmentalists, and every day citizens to work collectivity to reform our broken food system by preventing food waste. In the end, we certainly all stand to benefit.

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