

2040: A Zero Food Waste Society

The Eco-Socio-Technical System of the Future



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ABSTRACT

In the year 2040, societies interact differently with their technologies and with the natural world than they have in the past. New systems that are comprised of all three components—society, nature, and technology—reflect changes in the human perspective on both the purpose of technology and the resilience of nature. The paradigm shift was brought on by previous generations of excess food waste that exceeded natural assimilation capacities.

This paper addresses the problem of food waste in past decades and provides an overview of what life is like for modern people living in 2040 with zero food waste. In short, the 2040 system is made up of dynamic and sustainable relationships between society, technology, and nature. Crop production, food storage, and recycling methods all seek to reveal natural production potential without degrading environmental quality. Thanks to a reallocation of government subsidies, agricultural practices move away from earlier large-scale monocropping models toward small local farming. Local farming connects consumers to the food system and allows them to see the land their food is derived from. Food waste is also reduced by changes in the perception of what food ought to look like. In past times, a large amount of perfectly edible produce was thrown away because it was not aesthetically pleasing according to social conventions. In 2040, all produce that is harvested is brought to markets, regardless of what it looks like. The remaining aspects of the system take place within household and involve both food storage and disposal. First, consumers buy food in small quantities, making it more likely for food to be consumed before it expires. Improved food storage technology extends the shelf life of food and alerts consumers when it is soon to go bad. Many food scraps are repurposed, however all spoiled food and food scraps that cannot be repurposed are composted. Compost generated in households is collected by municipalities and sold back to farmers who use the soil to grow new food.

Additionally, this paper provides a historical account of the events and processes that marked the transition toward a zero food waste society. Though progress was fluid and complex, it can generally be understood to include three stages: exploitation, recognition, and symbiosis. The first period, lasting from about 1920-1990 was a time of growth and expansion, unchecked by consideration for natural limits. Natural resources were exploited, crop yield increased with the use of chemical fertilizers and pesticides, and consumption increased at exponential rates. As

a result, waste—and particularly food waste—increased as well. With the rise of the new millennium, humans began to gain recognition of the interconnections between society, technology, and nature. However, developing a new social perspective took time and this period, lasting from about 1990-2025, includes small scales shifts that eventually lead to a final stage of symbiosis. In the current period, beginning around 2025 but not fully taking form until 2040, humans have a new system of food production and consumption that eliminates food waste.

The 2040 model of zero food waste marks a transition in which societies begin to understand their relationships with technology and nature. The system is more environmentally sustainable, but provides benefits to societies that make reverting to old ways unfathomable. Future progress after 2040 will be measure based on increased sustainability, rather than on levels of development and exploitation.

HOW DID WE GET TO 2040?

Documentation of Progress to a Zero Food Waste Society

We've come a long way since 2016; our world today is vastly different than that of yesterday. We have a newfound awareness of our surroundings and the systems in which we live. It took time to get to this point, thus the story of how we got here is crucial to understand how we have developed as humans. While the history of our situation is important, there are two other pieces of the story which help give an understanding of the society we live in today. The first of these comes in the form of technus. It has shaped how we interact with our environment and how we live our everyday lives in a sustainable manner. The second is rooted in our social structure and our attitude/awareness of our place in the environment and how we orient ourselves in a global context. Each of these contributes to a broader comprehension of how humans behave in a post-modern sustainable society.

I.

Everyone had thought that 2016 would mark the end of the civilized world. With Great Britain exiting the EU and the election swinging in Donald Trump's favor, things looked grim. I was home watching the country and world fall apart before me. The Dow Futures was down 1000, the peso had depreciated 30%, the planet trembled in fear; all because of one man. We held our breath, terrified of the coming reality but nothing changed. The government governed and the people listened, leading the U.S. to prosperity. The unemployment rate dropped while wages increased. As the middle class flourished, the economy exploded and consumption skyrocketed. The demand we saw in the following years was unprecedented; It was considered the second golden age in American history.

It continued into his second term, something nobody ever thought could happen; America continued to prosper. Yet, this prosperity was not without consequence. Due to the ensuing golden age, consumption among the exploding middle class skyrocketed. As a result of mass amounts of consumption, waste management companies became overrun with the waste products of the people. Landfills began to struggle from the influx of trash and began scrambling for alternative solutions to the problem. It was a growing issue, however nobody officially addressed it until environmentalists began perusing independent initiatives to reduce our waste production.

They started composting programs in communities, encouraging others to recycle instead remove. The ugly fruit movement swept across the country in an attempt to reduce food waste and our demand for more. The environmentalists were successful in their endeavors, bringing the impending waste crisis to the public eye and reducing the national food waste average by 50% by 2025. Despite this, we were still overrun with trash. We had consumed too much and our planet was hurting.

Our landfills couldn't handle it and we were running out of space. Trash pits were beginning to inch towards our communities. Our water supplies were being contaminated from infringing landfills while air quality plummeted. The consequences of our consumption had become a public health hazard. In response to this, the federal government imposed strict regulations on waste management practices essentially limiting any further expansion. In addition to these, the government limited family waste production. With this legislation, the state was able to limit the waste output of a household to 30 lbs/week although many families were producing less than half of that. The final set of regulations enacted turned towards the placing responsibility, in part on the producer. Food producers were required to use biodegradable materials in their packaging in an effort to reduce the amount of waste going into the environment. By 2030, the United States had cut its average waste production by 65%.

In the years following, waste management companies began addressing the landfill problem by incinerating the rotting trash. This allowed for consumers to fall back in line with old habits resulting in waste generation to rise by an average of 5 lbs/person/week. This lasted only a few years until 2033 when the government halted the practice due to the spike in GHG emissions released by the landfills.

At this point, society shifted its focus to the environment and the individual and a new environmental revolution had begun. The vast majority of the United States took initiative within their townships to reduce overall waste production, isolating themselves from external factors. This created microcosms, which are the basis for society today. As a result of the small scale of the new system, society had effectively reduced their consumption by 45% and their average waste output by almost 90%. Composting and recycling became regular practices throughout society, with an increased focus on the use of biodegradable materials. Momentum continued throughout the first half of the decade, prompting the United States government to implement policy that would accelerate the movement into a sustainable future. As a part of this no impact

movement, the government instituted the Green Agriculture Act of 2035. In this piece of legislation, federal authorities began reallocating farm subsidies from large agricultural operations in the mid-west U.S. to local farms. In doing this, supply side food waste plummeted along with post-consumer waste such as packaging etc.. This was the final push the movement needed. The G.A.A. catapulted the United States into a sustainable future leading to the society we live in today where the average American produces 99% less food waste than in 2016.

Towards the latter half of the 30's, society began understanding the role that trash/waste could play in the agricultural system which lead to the commoditization of food waste. The development of new practices coupled with the advancement of old ones led to a breakthrough process, which converts the byproduct of human consumption into food for livestock, fish, and other animals as well as a viable fertilizer for crop fields. This breakthrough created a closed loop system that utilized the massive quantities of trash that were stored in landfills. With this discovery and the increased environmental awareness from the public, the United States slowly began to reverse the negative impacts that the golden age of Trump had brought about.

In 2016, the way we lived was based on a capitalistic society that rewarded more. As a result, overconsumption plagued the nation, affecting society and the environment in a severe manner. Although we have been able to overcome the negative externalities of our actions they could have been prevented. It is easy to look at things in the short term, whatever that may be. For most that make the laws, that is 4 years. But 4 years is a brief moment in time. We kept thinking in the short term and ignored the future; we paid the consequences of our ignorance.

Looking at our country's development on a macro scale gives insight into how change has been made across decades reflecting a shift in the national attitude towards the environment and sustainability. In order to gain a better understanding of this new mentality, it is important to narrow the scope of analysis and observe an individual citizen. Below is a personal digest of a resident of New York City documenting the new age social attitude towards sustainable food waste practices.

In compiling our analysis, we asked a journalist to chronicle their day-to-day schedule in order to gain insight into how attitudes and social norms have changed to fit the changing world. This is arguably the largest contributor to the success of our new society. Below is an excerpt from their submitted digest.

II.

On Saturday I wake up and go to the market to buy groceries. The market is located in a large building in the center of town. There are two other markets in town, but I always go to the one in the center of town because it is the largest and has the most variety. The market looks much like I remember grocery stores looking when I was younger, however the isles contain almost exclusively unprocessed foods. Additionally, the food choices are not consistent throughout the year and change with the seasons because most of the food is provided by local farms. Because the market is near my house, I usually go at least four days a week: Saturday morning, Sunday night, Tuesday night, and Thursday night. This way, each time I go to the store I can get exactly the food I need for at most two days.

After going to the store, I go home and put away the groceries. From the fruits and vegetables I buy, I save the stems and inedible parts to cook into stock. I then dispose of any other food scraps in my compost container. Each month, compost in my apartment building is collected. Similar to recycling processes that sort different plastics, soil from various containers is kept separate and evaluated for its different nutrient composition. It is then sorted and sent to farms, landscapers, or used for other projects. Only soil that is completely composted can be picked up. If there are still large food scraps in the mix, I will be penalized with large fines. Because of this, everyone has at least two compost bins so that food is not placed in one that day that it is being collected. Because the compost process can be negatively affected if I dispose of too much natural waste at once, it is necessary for me to monitor how much I dispose of. In addition to finding new ways to use food scraps (such as making stock and using fruit that may go bad to make preserves) I must also watch how much I buy each day and how much I cook.

I remember when I was a child, my mom used to stock our fridge and pantry full of food that could have fed us for at least three weeks. Now, my apartment does not have a pantry and the fridge is only large enough to fit small cartons of milk. The food I buy is always consumed in less than 48 hours, so it is unnecessary to have large amounts of storage space. It seems odd and unsanitary that it was once normal to keep food for long periods of time. Who would want to eat anything that has been sitting for more than a week after being harvested? The food at the market is local and comes from growers in the nearby area. This allows farmers to harvest only food that will be bought each day and further reduces the time between when food is harvested and when

it is consumed. Additionally, food is now able to grow and ripen on the vine, rather than post-harvest. All of the food grown is harvested, regardless of its aesthetic appeal. There used to be social constructs of how certain foods should look. For example consumers would turn down food that had uneven coloring or that was slightly misshapen. Now however, there is a sense of pride in buying produce with unique characteristics.

Most weekdays while I am at work, I go out to eat on my lunch break. The culture at restaurants, which was once a large contributor to food waste, has also changed dramatically. Restaurant goers are encouraged to take food home, but are charged for any amount of food that is left on plates. Additionally, all restaurants offer at least three sizes of each meal to help minimize the amount of food that is wasted. I began to notice small changes in the restaurant industry in the early 20's but the shift was not universal until the mid 30's. I have heard that restaurants also sell any food scraps back to farms to be used as fertilizer in the fields. Because most food is locally sourced, the restaurants give back to the farms that provide them with the ingredients they need, often in return for discounts on food. Restaurants have also been integral in reducing food waste on the production side. At the end of the day, when the market closes, farmers sell all the leftover food that will go bad before the next day to restaurants that will serve the food that night.

Without the help of human technology, our system would have collapsed. It is an important component of our new society, which allows us to have a heightened awareness of our individual impact on society/the environment. This has been researched extensively by engineers and scientists alike, leading to the publication of an analysis of these new technological systems. Below is an excerpt from their analysis describing how technology plays a role in our modern society.

III.

Here is how eco-socio-technical system works in future: In the future, Ecology, Sociology, and Technology will work together in a balanced form to keep society run well in harmony. Ecology will combine the food waste, natural environment in a peaceful way and use the inevitable food waste to contribute to the society. Society, in another way, will concentrate on developing new methods to understand food waste and create new policies and laws on the

food waste. Technology would grow that not only there will be ideas on how to reduce the food waste by human inventions, but also there will be the new outbreak on a sustainable food waste system.

The system would work in three different ways. Firstly, allow people to realize how important food waste is for our environment. In 2016, people tend to waste food with realizing how important food is for individuals in poverty and hunger and how important to reuse the waste of food. In 2040, public education would be necessary for the role of educating people. People in 2040 would understand the necessity and the reasons why not to waste. Therefore, they would take the amount of food within their expectation. On the one hand, people will eat while they make and on the other way, people will take what they eat. The cafeteria will serve a significant role in educating people not to waste food. For example, the amount of food would be measured in your plate, and after checking out, the waiter will weigh how much food you left, if the food waste exceeds the biggest amount, then there will be a penalty, such as \$100 for 1-kilogram food you left on the plate. In this restaurant case, Japanese's Rotating Sushi serves an excellent example. The Sushi goes in the circle and won't stop in front of anyone. Therefore, most people would only take one plate while they are eating. You usually see the piles of dishes pile up very tall but immaculate in each dish. Consumers would also save money in this way that they could see how they consume and how much money they spend. Technology such as a "rotating menu" or "rotating food service system" would help to reduce food waste.

Secondly, the technology would allow the food to have a longer expiration date without adding dangerous preservatives to the foods. Chemistry and Biology would find out how to extend the expiration date for the foods and make the time longer than 2016. Not only snacks would be expired longer than 2016, but foods would also expect a longer expiration date. Technology would keep the food preserved at room temperature. Vacuumed packages, for example, would expand to every food industry and technology also allow people to put the food into vacuum bags if they could not finish the food. The "vacuum again" food will preserve the same taste, and people could pick up and eat again in the next meal or a few meals later.

Thirdly, recycle and reuse is necessary for food waste. In the movie, "No Impact Man," Colin put his waste into his "worm box," and the worms would turn the wastes into soil and fertilizers and the food would turn from waste into treasure. In 2040, this "worm box" would turn into an industry. The government would have laws on the production of fertilizers and soils from

the food waste. The soils that grow food every year need rest periodically, and thus the new food would provide benefit for agriculture and farming. New soils would have the old lands rest and provide better fertilizers. Other food waste goes into “Animal Feeding System.” The food for animals in farms would eat the waste from people. The waste could also make foods for dogs and cats. Therefore, the food for animals does not require the “first-hand food material.”

Here is how the system works together: people began to ask their phones the amount of steps they walk and some calories they need before each meal. The APP could tell people suggested amount of calories and give images of recommending foods. People consume what they need without taking an enormous amount of food when they are hungry. Then, the food waste goes to different ways. First, food waste will be distributed into various categories, and the categories will detail by the elements in the food, the form of the food, and the packages of the food. Second, food that could not be finished eating will go to vacuum bag and preserved for another time. People could continue working on their food for their next meal. Thirdly, food recycles and reuse industry. There, new food for animals and used food for soils will be deposited and reformed to fertilizers.

CONCLUSION

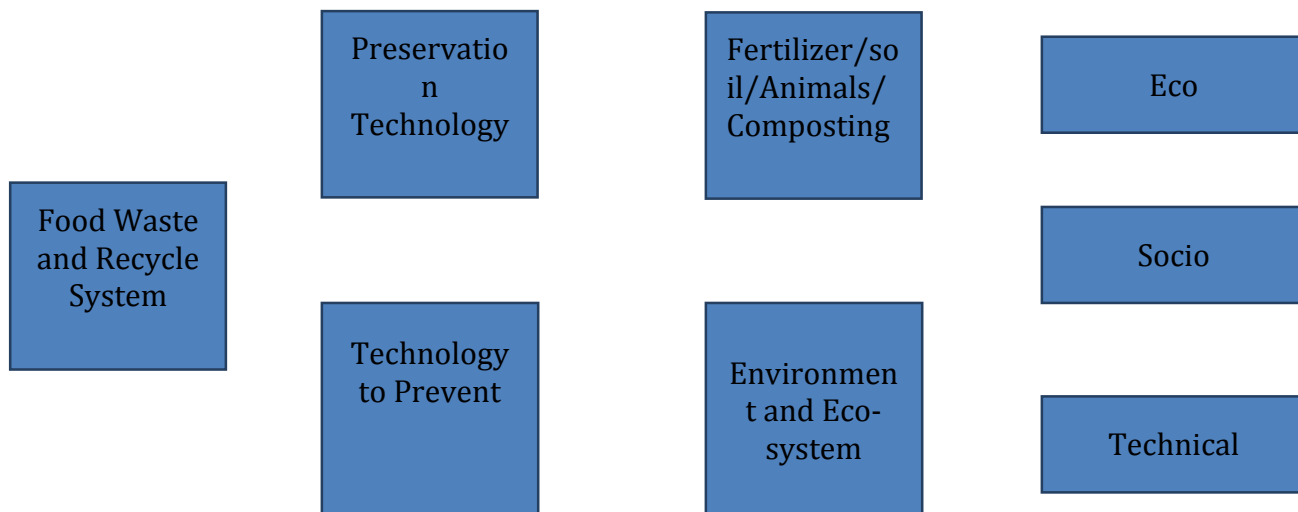
Living in the new world of 2040 is different from the way we live today. 2040 is the time of sustainability, and it is the time for public awareness to rise sufficiently. Food waste problem would be solved by the time of 2040. Zero food waste means the high efficiency of the consumption of food. The technology incorporates with people's attitude of preventing food waste. Systems such as the switch between refrigerator and freezers affect people's daily choices. The social environment raises people's awareness of the zero food waste system balances human interaction with our environment and the ways in which we protect it. This balance is affected by zero food waste and also influences food waste in a positive way. The new eco-socio-technical system results in a highly sustainable practice with maximized efficiency.

Policymakers also could take actions on reducing food waste and eventually hit the peak of zero food waste by the year of 2040. Acts and laws that combine using technology and balancing environmental justices would be performed.

Technology reveals nature through various methods. Technology showed how much food people consumed and how much food was wasted. By showing the amount of the food waste, technology gives people ideas on how to control the wasting. Technology also enhanced people's experience with diets in 2040. Eating is not merely feeding oneself to satisfaction but is about eating healthy and eating balanced. The balance people looking for is not only the healthy living style but also the sustainability that could benefit generations after generations.

Technology such as composting showed is an example where the compost bins become a staple in all American homes. Composting bins enhanced the efficiency of using food materials. Electronic devices helped people that people could have online ordering and online recipe suggestions. The improved living standard is the difference became 2016 and 2040. New environment also brings people closer to nature. People are closer to nature by the feeling of the participated in a sustainable world, and more people are educated to achieve sustainable goals from generations to generations. The mediation towards people from technology is not physical but more of a conceptual mediation. The graph below shows the system of zero food waste. The system divides into two mechanisms, which are preservation and Prevention. Preservation systems aimed at putting the waste into something useful. The technology of composting bin, fertilizers, and online technology would make the food waste for further using. Prevention

system aimed at educating people and making policy to lower the food waste to zero. Both the mechanisms contribute to a new Eco-Socio-Technical system in the year of 2040. People would see more clearly about their actions on the environment and people would be aware of the idea of “prevention” and “preservation.” Therefore, human’s happiness and health would be improved. The environment would be more improved, and less waste made the society sustainable. Technology would be able to corporate with nature. Technology and nature would also supplement for each other. The prevention system and preservation system would benefit environment and ecology in a sustained technical world.



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