EPA/600/R-19/095| September 2019|
www.epa.gov/research

United States Environmental Protection Agency

Food Waste Reduction in Military Kitchens

A Tracking Technology Demonstration at Fort Jackson

EPA/600/R-19/095 | September 2019 |
www.epa.gov/research

Food Waste Reduction in Military Kitchens

A Tracking Technology Demonstration at Fort Jackson

This project was conceived, designed, and produced by:

Steve Rock
Office of Research and Development
National Risk Management Research Laboratory
Water Systems Division
Water Resources Recovery Branch
26 W. Martin Luther King Dr.
Cincinnati, OH 45268

Alex Lan
Office of Research and Development
National Exposure Research Laboratory
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Notice/Disclaimer Statement

The information in this document has been funded wholly or in part by the U.S. Environmental Protection Agency (EPA). It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Note that approval does not signify that the contents necessarily reflect the views of the Agency. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

NOTICE: This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government, nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government, any agency thereof, or any of their contractors or subcontractors. The views and opinions expressed herein do not necessarily state or reflect those of the United States Government, any agency thereof, or any of their contractors.

This document has been reviewed by the U.S. Environmental Protection Agency, Office of Research and Development, and approved for publication.

Abstract

A food waste tracking system was installed in the kitchens at two of Fort Jackson's dining facilities (DFACs). The systems were built by Leanpath, leased by EPA for the project, and modified for use on an Army installation. Staff at the DFACs were trained in the use of the balance and recording systems. The staff and management together decided where in each kitchen was the most convenient location to place the system.

Our preliminary examination revealed the system at each DFAC worked very well—the system did not increase staff workload or add additional time to the task of food preparation or clean up—and resulted in a substantial reduction of food waste. Fort Jackson decided not to purchase the system at the end of the project due to inflexibility of existing kitchen contracts. Based on some of the observations in the pilot study, suggestions for initial consideration include conducting a long-term study at these and other DFACs to capture trends and site variation, and to explore techniques to reduce over-production of food—the primary cause of food waste in this study.

Foreword

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building science-based knowledge necessary to manage our environmental resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL), within the Office of Research and Development (ORD), is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threaten human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments, and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

Table of Contents

Table of Figures

Acknowledgments

The project was a collaboration of EPA ORD staff, Bill Michaud and Matt McMurtry from CSRA, and Leanpath's Todd Pendexter and Rhianna Derenick-Hannigan. The project would not have happened without the help and access provided by Tamaria Warren and the Fort Jackson team, including kitchen staff, administrators, and the environmental crew. Thanks to all.

Background

The U.S. Environmental Protection Agency (EPA) seeks to prevent and reduce wasted food (and other organic material) that would otherwise be lost as a resource into landfills[1]. Food loss and waste in the United States account for a large amount of the overall food supply available to retailers and consumers and has far-reaching impacts on food security, resource conservation, and climate change[2,3,4,5]. In the United States, food waste is estimated at between 30-40 percent of the food supply[3, 4]. This figure, based on estimates from USDA's Economic Research Service of 31 percent food loss at the retail and consumer levels, corresponded to approximately 133 billion pounds and $161 billion worth of food in 2010[5]. Food loss and waste is the single largest component of disposed U.S. municipal solid waste[6], and accounts for a significant portion of U.S. methane emissions, which is an important greenhouse gas[4]. This large volume of wasted food is a main contributor to the total U.S. methane emissions that come from landfills[4], which are the third largest source of methane in the United States[7]. The U.S. Department of Defense (DoD), through its vision for Net Zero Waste, seeks to reduce, reuse, and recover waste streams in order to create a culture that recognizes the value of sustainability; measured not just in terms of financial benefits, but benefits to maintaining mission capability, quality of life, relationships with local communities, and the preservation of options for the Army's future[8].

To this end, application of technologies that aid in determining the exact sources of food waste[e.g., 9], such as the Leanpath system, can potentially reduce pre-consumer food losses. Leanpath[10] is a patented technology that focuses on food waste prevention by using "smart meters" that weigh, record, and categorize the final disposition of food waste (garbage, compost, donation, etc.). These data are then transmitted to Leanpath via a wireless internet or cellular connection. Leanpath then analyzes and formats those data to be presented on a client-specific website (Figure 1).

The client uses these real-time data to determine the types of foods most wasted and the causes of the food waste. The client can use these data to make decisions on menu planning, cooking timing, and other ways to reduce food waste.

Several commercial operations have been using Leanpath successfully for several years[10]. For example, IKEA has implemented the Leanpath solution in approximately 20% of their kitchens which has translated to 176,000 saved meals[11]. This and similar technologies are a viable option to reduce the volume of surplus food prepared in dining facilities. Tracking technologies can also potentially provide data towards source reduction—a preferred step in EPA's Food Recovery Hierarchy[12].

The application of this technology, in the context of DoD operations, is potentially more difficult than some commercial kitchens due to unique institutional and social/behavioral factors. Thus, this technology's potential for use across Army installations seeking waste reduction goals is limited until these factors are better understood. This project seeks that understanding and to share that knowledge with DoD.

Figure 1 Sample of Leanpath Dashboard

EPA's Office of Research and Development (ORD) has a partnership with U.S. Army for Installations, Energy and Environment (IE&E) around Net Zero for energy and water usage, and for waste reduction[1]. The objective of this project was to provide a proof-of-concept evaluation and demonstration of a food waste prevention technology that can potentially be used to achieve zero-waste-related goals. Demonstrations were in two dining facilities (DFAC) at Fort Jackson, South Carolina. The evaluation took place February June 2017. EPA, with their contractor CSRA, acted as an impartial third party to support and monitor the use of the technology in the military setting through the pilot project at Fort Jackson. This support included: developing the pilot planning process; leasing the equipment; attending kick-off meetings and installation of the system at Fort Jackson; providing limited technical and programmatic support to Fort Jackson staff; monitoring system usage; interviewing Fort Jackson environmental staff, DFAC staff and management; and developing this report.

The DFACs

Following several stakeholder meetings, participants agreed the pilot would take place at the Advanced Individual Training (AIT) and Drill Sergeant Academy (DSA) DFACs February June 2017. Dr. Tameria Warren, Senior Project Manager in the Department of Public Works Environmental Division and Ms. Anne Morrell, Fort Jackson Installation Food Program Manager, worked closely with management staff at both DFACs to get the necessary buy-in for the pilot demonstration to take place in these DFACs. This was especially important given that the DFACs are managed by outside contractors under a government contract. Their current

contract did not have a clause to conduct pilots of new technologies, so Dr. Warren's and Ms. Morrell's efforts were essential in obtaining the permission and support of the DFAC management.

Leanpath delivered and installed the equipment as part of the kick-off meeting on 1 February 2017. In addition, they provided DFAC management and staff with training on use and maintenance of equipment, online and telephone technical support throughout the pilot demonstration, and multiple coaching calls to answer questions, review transactions, and guide changes for food waste reduction.

Both DFACs serve breakfast, lunch, and dinner in a self-serve cafeteria style and must be able to provide the same meal options for all soldiers, from first to last soldier. Menus are dictated by the Army and the DFACs have little to no options to deviate from the directive. Given the nature of training that takes place, DFACs prepare meals for the expected number of soldiers on post and in training, but often entire training cadres miss meals due to training activities. In addition, the nutrition and health of each soldier is monitored throughout the training process and they may be put on calorie restriction (the individual's choices and quantities are limited). DFACs have limited ability to plan for either the no-shows or the number of soldiers on calorie restriction. Based on interviews with DFAC management and staff during the kick-off meeting, both DFAC's staff believed they were wasting more food than they should, but they did not have any data outside of quantity of food purchased and number of soldiers served.

AIT DFAC was the larger of the two pilot sites. The AIT program trains over 8,000 soldiers per year. Customers for this DFAC are soldiers in the AIT program and other local base personnel. They serve approximately 1,000 meals a service (i.e., breakfast). During a given meal, the staff and management are constantly working to keep the line fresh and clean. They are preparing and cooking throughout most of the meal. At the outset of the pilot, they believed that they would have limited time to address any "new" changes to their food preparation processes, but they were willing to give the Leanpath system a try. There are two main food preparation and cooking areas in the kitchen, but there is only one waste disposal station. The goal was to install the Leanpath system directly adjacent to the waste disposal station to facilitate ease of measurement prior to disposal. Because there was no available power outlet at the disposal station, the system was placed around the corner (Figure 2). Placement of Leanpath system was not ideal, and Fort Jackson's environmental staff and DFAC management tried to remedy the situation by requesting installation of an outlet, but outlet installation was not accomplished in time for the pilot.

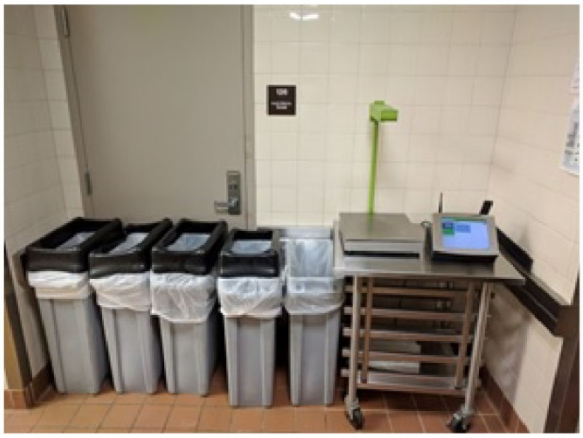

Figure 2 Leanpath System Installed in AIT DFAC

DSA DFAC is a smaller DFAC. The DSA trains 2,200 non-commissioned officers (NCOs) per year and often has up to 500 NCOs in training at any time. They can serve up-to 500 meals in a service. The Leanpath system was placed very close to their waste disposal station (Figure 3). Their meal preparation procedure is to prepare and cook all the meals expected for a given service before it starts and during a service only prepare and cook items that run out unexpectedly during the meal. One challenge the DSA DFAC has that AIT does not is that the NCOs are permitted to eat off base or at a DFAC of their choosing, so the number of diners for any given meal can fluctuate greatly and is much harder to predict.

Figure 3 Leanpath System in DSA DFAC

Each DFAC has three food waste streams: 1) preparation waste from preparing and cooking food, 2) plate waste from diners, and 3) food from the serving line that was not taken by the diners (i.e., unserved). The Leanpath process is installed in the kitchen and can only record the preparation waste and food that is returned to the kitchen unserved. For the food waste generated during preparation or food from the line that was not served, the kitchen staff places the waste on the Leanpath scale; users enter identity of the food (e.g., beef, vegetables, pancakes, etc.); why it is being disposed of (e.g., trim waste, expired, spoiled, etc.); and how it is being disposed (e.g., garbage, food donation, etc.). The system takes a picture of the waste for QA/QC and sends all these data to Leanpath, via a cellular connection, where it is tabulated and analyzed. The system registers the entry and provides a summary on screen so the user can see and verify what is being recorded. The Leanpath system also can provide real-time information regarding how the kitchen is operating/performing to help connect the user to the kitchen's overall waste minimization goals. Leanpath has found that this these features allow for real-time conversations and heightened focus that can lead to buy-in with kitchen staff. Instant feedback encourages engagement (Figure 4). Another way to encourage use and buy-in is having the user entered into an instant win drawing with each waste entry; and many commercial kitchens provide small rewards to the winners (e.g., longer breaks, small cash rewards, etc.). For this pilot, the instant win feature was enabled, but both DFAC management and staff knew that there were no prizes.

DFAC management and staff expressed interest and curiosity about the Leanpath system. For example, they questioned the granularity of the waste selection, and wondered why some vegetables were selectable (e.g., potatoes) whereas other had to be grouped into a general vegetables selection. Leanpath explained that the system selections were set up in such a way to improve efficiency of entering transactions so they could be completed in only a few seconds. If there were detailed choices, a user would have to page through an enormous number of pages to find the specific waste, hence greatly increasing transaction time. Higher transaction time is a negative because it tends to be a disincentive to use the system and potentially lowers the efficiency of the kitchen. The average transaction time was twelve

seconds. Waste data are presented to authorized stakeholders via an online custom dashboard (Figure 4).

Figure 4 Sample Leanpath Summary Screen

Pilot Results

Overall Fort Jackson Results

To determine if the Leanpath system resulted in reduction of waste generation, a baseline was established. Leanpath normally recommends using the first full month of use as the baseline, but for this pilot the first month (February) was used by the DFAC staff to become acquainted with the system and develop the procedures and processes necessary to use the system in their day-to-day operations. Therefore, the month of March, the second month of system operation, was selected as the baseline for evaluating the impact of the system on food waste at the two DFACs. There was a clear trend in reduction of food waste, showing a decrease of 3,554 pounds from March to June (Figure 5). This decrease was captured during 3,499 total transactions in the Leanpath system and included 31,848 pounds of food waste. The total reduction from baseline represents an 11% decrease during the period.

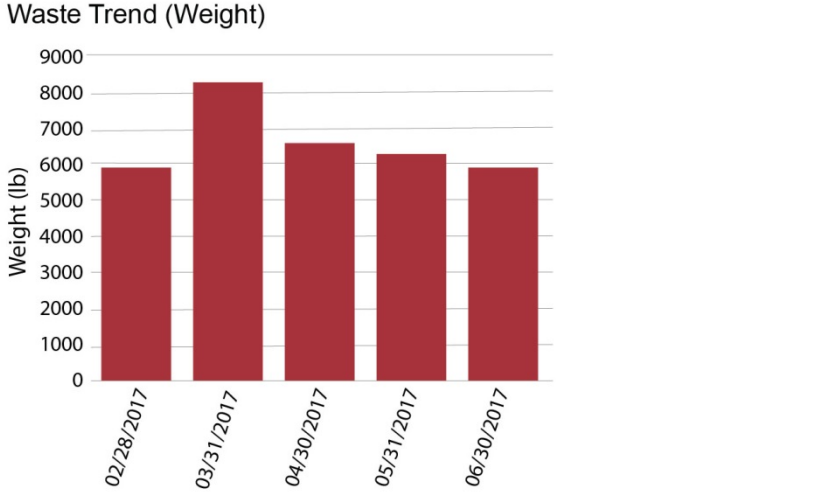

Figure 5 Overall Waste Disposed for the Pilot Period at both DFAC's

Fort Jackson had a 2014 food waste audit conducted by the Army Institute of Public Health. It showed that food waste was approximately 40% of the Fort's municipal solid waste (MSW) stream. Dr. Warren was able to provide the total MSW for the Fort for February-June 2017 (Figure 6), but this approach may not be a good barometer of the food waste minimization. It is

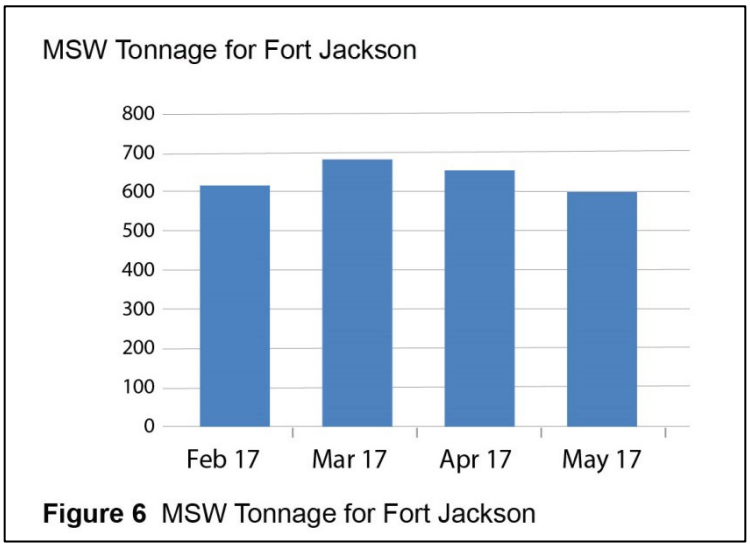

Figure 6 MSW Tonnage for Fort Jackson

assumed that the composition of the MSW stream is the same as the 2014 study, but without a detailed audit of the waste stream it is difficult to say with any certainty if there was reduction in waste for the two DFACs. Also, some of the food waste recorded by the Leanpath system may have been disposed of through in-sink grinders, so the waste would never enter the Fort's MSW stream. Figure 6 shows a relatively stable MSW stream at Fort Jackson was relatively flat across the months.

Based on interviews of management and staff from both DFACs at the end of the pilot period, the overall decrease in waste is reasonable given that all persons interviewed stated that they believed that they were working more efficiently and producing less waste. Importantly, management of the DSA DFAC changed their standard operating procedures based on reviewing their data, discussed in detail below, so it makes sense that there was a decrease in the amount of food waste produced.

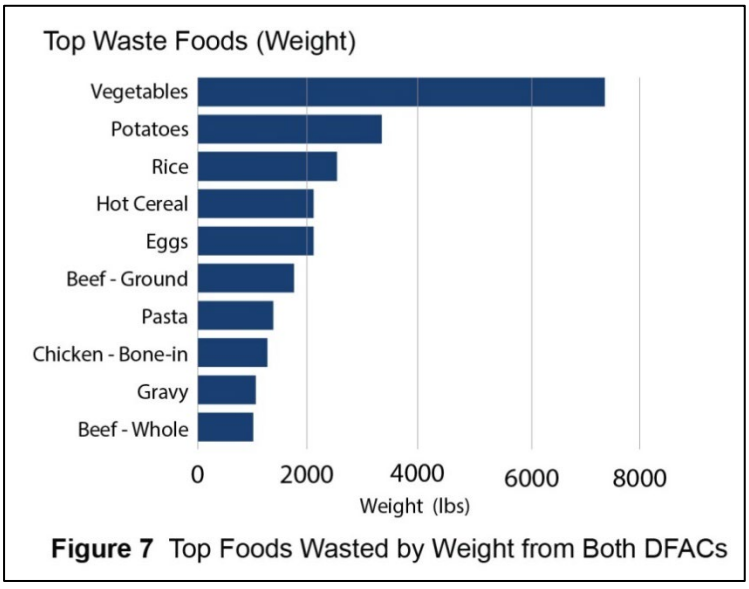

Figure 7 Top Foods Wasted by Weight from Both DFACs

As discussed above, the food waste stream can be characterized by either the amount of or the value of food wasted. Looking at the data from both DFACs, vegetables were by far the largest food waste item by weight (Figure 7). When looking at food wasted by relative dollar value, whole beef (e.g., steaks) is the loss leader by dollar value followed by ground beef and vegetables (Figure 8). It is interesting to note that turkey was not in the list of Top 10 items of food wasted by weight, but it is listed at number four in terms of value.

The system provides insight into the disposition of the food waste. The majority (62%) of food was thrown away (Figure 9), but 37% was donated to a local area food bank through a new program at Fort Jackson that started because of this pilot. By examining the disposition and waste data, management was able to identify spikes in food waste on the same days that food was to be donated. It seems there is a tendency of kitchen staff to not conserve their food preparation when they think the extra food will be donated. Management was able to stop the excess food preparation once it was identified by showing that food donation, while valuable, was a small part of the food wasted and that only certain foods could be donated. Less than 1% of the food was disposed of via composting (Figure 9). This is an example of user input error as neither DFAC had access to composting during the time of this pilot. Fort Jackson hopes to restart a composting pilot program sometime soon.

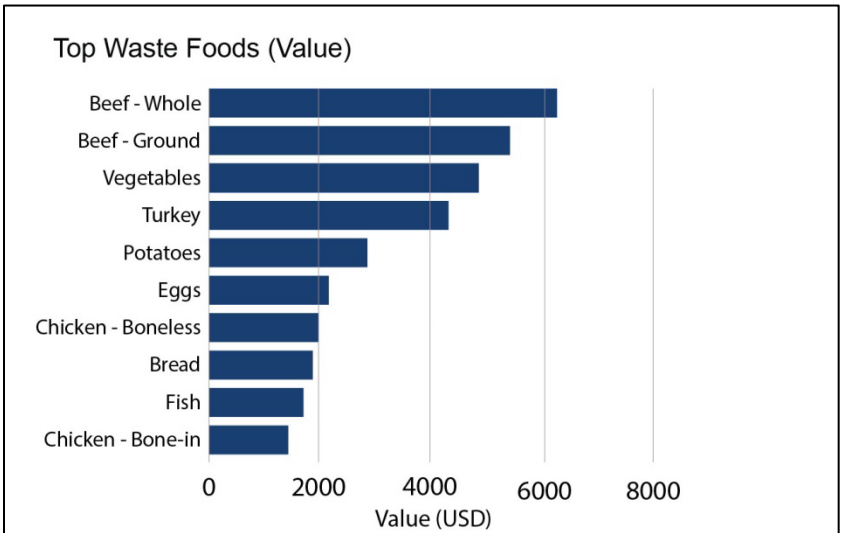

Figure 8 Top Foods Wasted by Relative Value from both DFACs

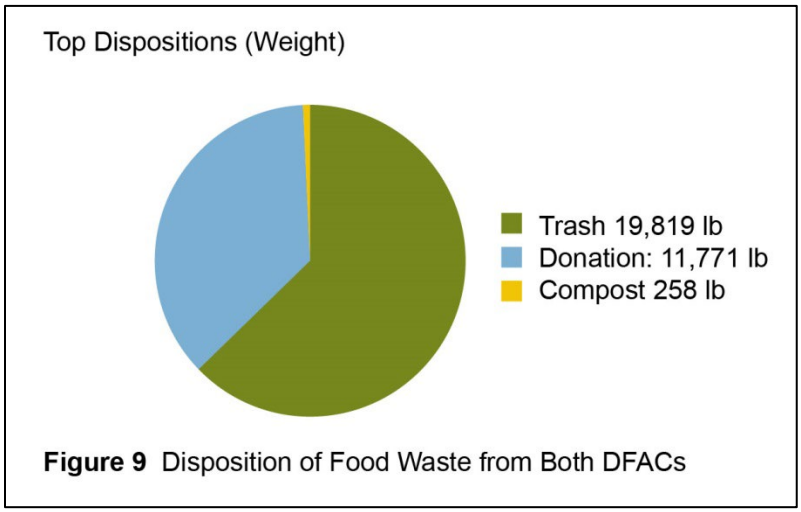

Figure 9 Disposition of Food Waste from Both DFACs

The demonstration also provides insight into why food is being wasted. To better serve these specific DFACs, Leanpath added two additional reasons for food waste. The first is calorie restriction—when higher caloric food is produced but individual soldiers or entire units are not allowed to have them based on orders from Army nutritionists. DFACs are not told how many units or individuals will be on calorie restriction during a given meal so they prepare a wide range of options. The second added reason for food waste is when a unit is scheduled to have a meal at a DFAC but does not show up due to training requirements, such as field exercises. This is especially a problem at the AIT DFAC because NCOs have the freedom to have meals off-site. Their management is hoping to use Leanpath data to encourage better communication between the DFACs and the unit commanders.

Overproduction was by far the primary reason (83%) for waste (Figure 10). Given that kitchen staffs are the users who input the data into the system, they may not have good insight into whether the waste is due to mistaken overproduction, calorie restrictions, or field exercises. Better training of those entering data and communication between management, unit commanders, nutritionists, and kitchen staff would be required to decrease this type of food waste. Based on interviews with DFAC management, it is believed that both field exercises and calorie restrictions are bigger drivers of loss than these data suggest.

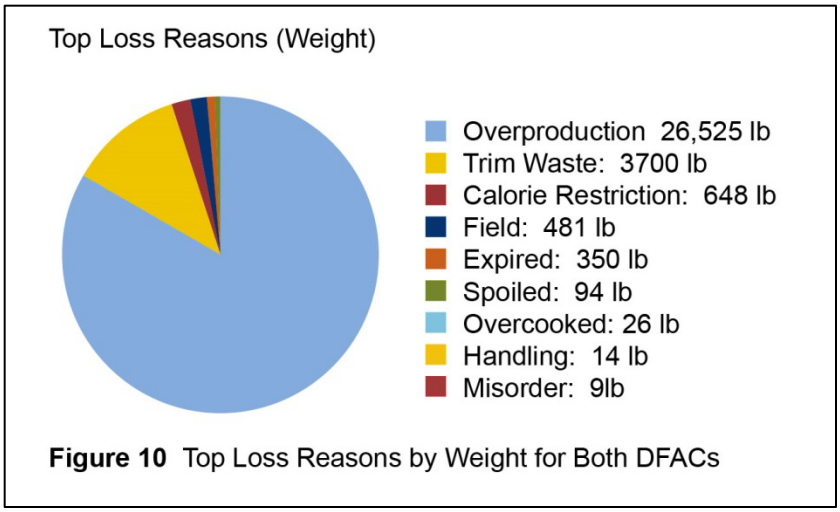

Figure 10 Top Loss Reasons by Weight for Both DFACs

This pilot was very well regarded by Fort Jackson. All the stakeholders interviewed after the pilot indicated that they believed that the Leanpath system helped them be more aware of food waste and they wanted to continue to use the system after the pilot ended, if possible. The Director of Public Works for Fort Jackson and the Environmental Division Chief were supportive of the pilot and very interested in identifying ways to continue to use the technology in the future. Dr. Warren stated that the pilot was mentioned in the base newspaper, *The Leader*, and was highlighted during local news coverage of the Fort. Dr. Warren also presented the pilot at the South Carolina *Don't Waste Food SC* Year in Review. Ms. Morrell stated that she used these data and mentioned the pilot in her weekly updates to both her command and the garrison commander. Because of her updates, two other facilities, West Point and Fort Bragg, have expressed interest in getting similar systems.

Ms. Morrell stated that they provided these data to their command in hopes that they could influence the menu selection required by the Army. The hope is if they can show that certain types of food are wasted on a regular basis, it is possible that those items will be changed in future menu selections/requirements. It is also possible that, based on these data, DFACs could show a need for more flexibility in what should be prepared for the soldiers. This outcome is somewhat unlikely given the strict nutrition regime that the Army has for its soldiers.

Dr. Warren and Ms. Morrell also stated that, if funding were available, they would keep the existing Leanpath systems and even install new systems in the other DFACs on base. This currently is not happened for two reasons. First, there currently is no funding in the budget to maintain or install Leanpath systems outside of the pilot period. Dr. Warren said that the DFACs were investigating ways to secure additional funding in the future. Second, the current contracts that manage the DFACs do not include provisions to require the use of a Leanpath-

like system. A new contract or an amendment would be required for the contractors that manage the DFACs to install, use, and maintain these systems. Contracts to manage the DFACs come up for renewal periodically, and Ms. Morrell noted that they were investigating contract language that would allow for the incorporation of a Leanpath or similar system to help track food waste in their DFACs.

AIT DFAC Results

The AIT DFACs experience overall with the Leanpath system was positive. Their management thought that the system helped them better understand their operations and how much food was being cooked, wasted, and donated; and what ingredients needed to be saved or handled differently. Their staff was a little apprehensive using the system due to a general fear of breaking or damaging the system. This apprehension is most likely due to limited training during the kick-off meeting and/or the fact that the system had a failure and had to have a part replaced early in the pilot. During the interviews, Ms. Morrell and DFAC management suggested that additional training resources, like a recorded training session, could be useful to reinforce the proper use of the system. To address staff apprehension, only certain trained staff members could use the system. To ensure accurate data and that all waste transactions were being captured, it would be ideal if all kitchen staff were trained and familiar using the system.

The AIT DFAC staff who used the system and were interviewed felt that the system was easy to use and that thinking about food waste led them to be more efficient in the kitchen. The system was a little time consuming due to its location in the kitchen. For the pilot, the system was located around the corner from the normal waste station. This dislocation from the normal waste station could have led to possible missed waste transactions, especially during the normal rushes of service.

One issue identified by AIT DFAC was that they have a continually changing group of customers. One unit enters AIT and trains for 35 days and then leaves the base for other assignments. This constantly changing customer base makes preparing food for the tastes of a given unit very difficult. They think that at the beginning of a unit's rotation through AIT they have higher food waste. By the time the unit is rotating out, they have made small changes to their production, staying within the Army mandated menus, to minimize food waste by adjusting

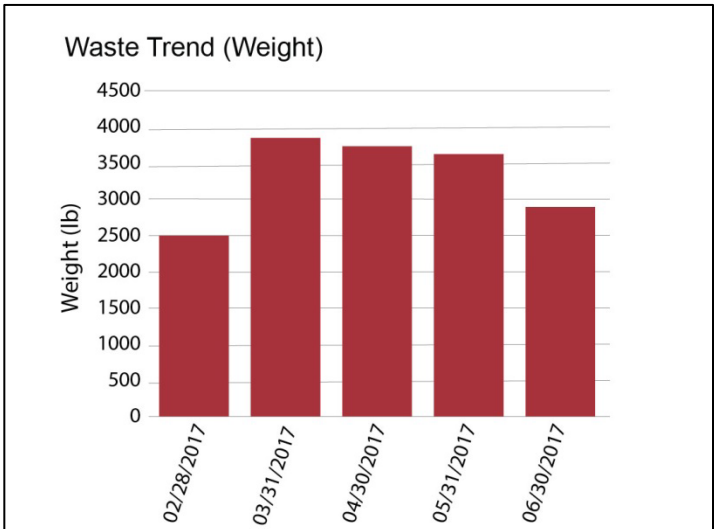

Figure 11 ATI DFAC Waste Trend by Weight

quantities based on their diners' likes and dislikes. AIT DFAC managers and staff thought that perhaps the Leanpath data could help them better recognize these trends sooner.

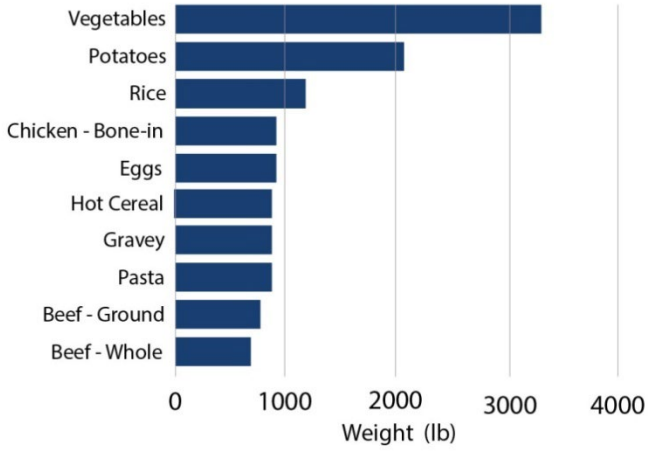

Figure 12 ATI DFACs Top Foods Wasted by Weight

Figure 13 ATI DFACs Top Foods Wasted by Relative Cost

Over the course of the pilot, the AIT DFAC executed 2,113 separate waste transactions representing the disposition of 16,485 pounds of waste (Figure 11). Compared to the baseline month of March, the AIT DFAC decreased food waste by approximately 1,078 pounds. The top wasted food by weight for the AIT DFAC was vegetables (Figure 12). This was not unexpected by the DFAC management and staff, but they suggested that it may be useful to have more specific information (i.e., the types of vegetables). They suggested that they could identify the top five vegetables used in the kitchen and have them identified clearly in the system and then have an "other vegetables" option. This could provide management more actionable information.

Figure 13 shows that whole beef was the highest value of food wasted. Note that both turkey and pork are on the top foods wasted by relative value, but the volumes of waste were not in the top ten of foods wasted by weight shown (Figure 12). Most of the waste is from overproduction (Figure 14). As discussed above, it is possible that some of this reported overproduction is due to field exercises (e.g., units unexpectedly not reporting for meals) or calorie restrictions.

AIT DFAC was able to donate approximately 40% by weight of their excess edible food to a local food bank (Figure 15). As discussed before, by examining Leanpath data, management noticed a trend of higher food waste on days when the food bank was collecting donations. Management believed that this was due to kitchen staff cooking extra food knowing that if it was not eaten by the customers it would be donated to a good cause such as the food bank.

Management addressed this issue and the DFAC is now producing food at a more stable level regardless of whether food is being donated or not. It is also important to note some user input errors in the disposition of waste—230 pounds of waste were sent to composting even though composting was not available at Fort Jackson (Figure 15).

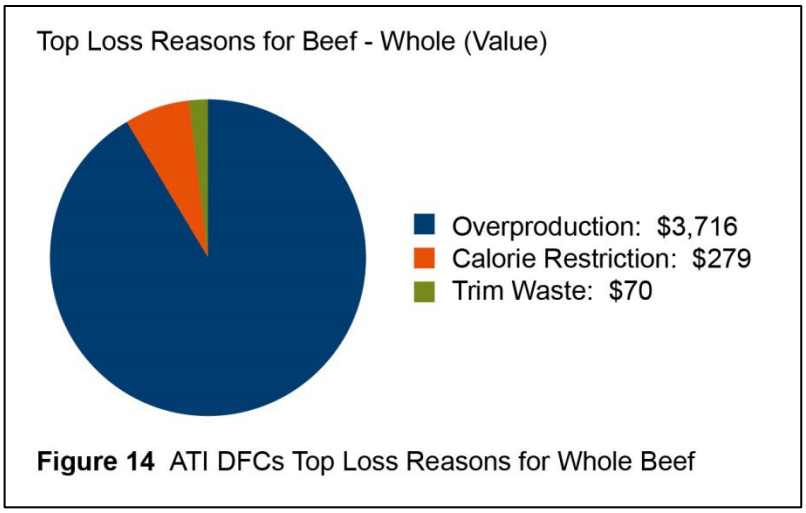

Figure 14 ATI DFCs Top Loss Reasons for Whole Beef

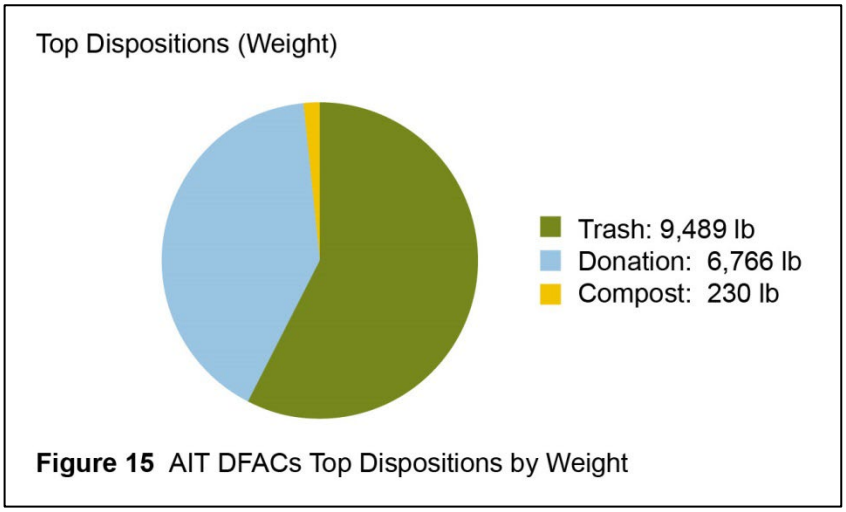

Figure 15 AIT DFACs Top Dispositions by Weight

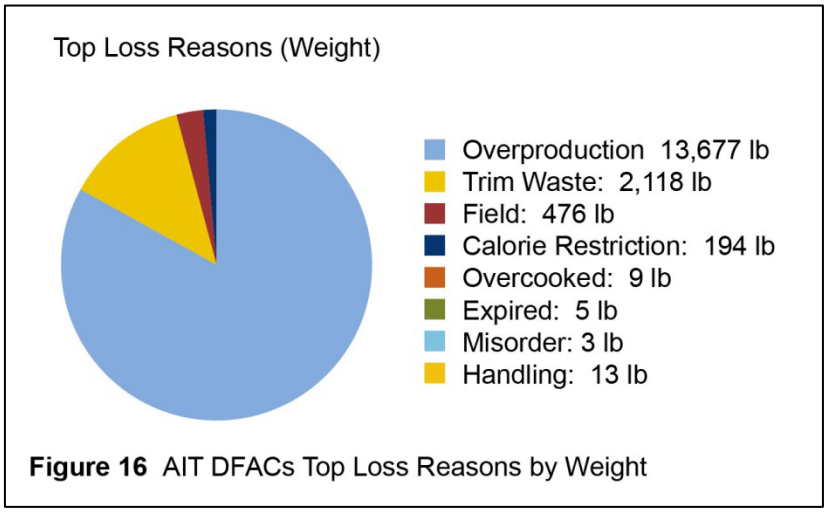

Figure 16 AIT DFACs Top Loss Reasons by Weight

Overproduction is the primary reason for waste at AIT DFAC according to data (Figure 16). As discussed above, field exercises and calorie restrictions probably play a larger role than what is revealed in these data. DFAC Management has been able to use these data to show that field exercises have a material impact on their operations and hope that they will be able to use this information to foster better communication between unit commanders and themselves.

DSA DFAC Results

DSA DFACs experience has been extremely positive. Both management and kitchen staff interviewed thought that the tracking system helped them be more efficient and reduce food waste. The kitchen staff enjoyed using the system and seeing instant feedback, as shown in Figure 4. DSA DFACs management said that the Leanpath data have allowed them to make operational changes that led to significant cost savings and waste reductions. Before using the Leanpath system, they cooked all the food for a given meal and kept it in warmers until it was needed. After seeing how much food was being wasted, management moved to a progressive cooking process where food is prepared throughout the meal service based on the demand. Although no behavior changes were noted specifically for how they deal with trim waste, all the cooks said that they were more aware of food waste and tried to minimize it.

Given that the DSA DFAC handled a lower volume of customers per meal and the Leanpath system was placed in a more ideal location in the kitchen, it functioned more like commercial kitchens where Leanpath has worked with previously. Therefore, it is not surprising the system was well received and provided actionable data. The primary concern for management was that NCOs do not have to eat their meals at the DSA DFAC. This choice adds uncertainty in the number of customers they serve for any given meal.

The Leanpath system at DSA had a failure in its network card and it had to be replaced. Leanpath shipped the replacement part and it was easily replaced by Fort Jackson IT staff. DSA DFAC management said that the process went very smoothly.

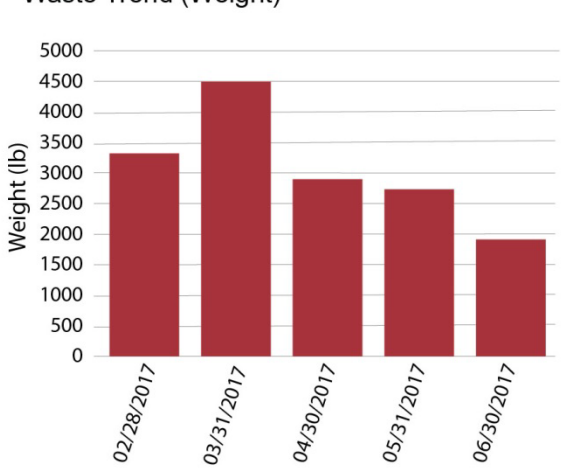

Figure 17 DSA DFAC Waste Trend by Weight

Over the course of the pilot, DSA DFAC executed 1,386 separate waste transactions representing the disposition of 15,363 pounds of waste (Figure 17). If we again consider the baseline month to be March, they saved approximately 2,576 pounds of waste by the end of the pilot period (Figure 17). It is likely much of the reduction in food waste is due to the shift to progressive cooking (cooking as the food is consumed instead of all prior to the meal service).

The top wasted food category by weight for the DSA DFAC was vegetables (Figure 18). This was expected by the DFAC management and staff, as not all soldiers like to eat their vegetables. They felt that the general category was good enough for them to make some decisions. There was concern that additional options may confuse the process that they had learned.

Figure 18 DSA DFACs Top Foods Wasted by Weight

An interesting side note is that the kitchen staff was surprised that pancakes did not make the top ten list given that they felt they were frequently disposing of expired pancakes during breakfast service. Bread was also thought to be a major contributor to the waste of the DFAC and it shows up on both the top ten list by weight and relative cost.

Ground beef was the highest value of food wasted (Figure 19). This is different from AIT DFAC where whole beef was the highest valued item wasted. When asked, DSA DFAC management did not have any real insights as to why ground beef was "wasted" more in this DFAC as opposed to others.

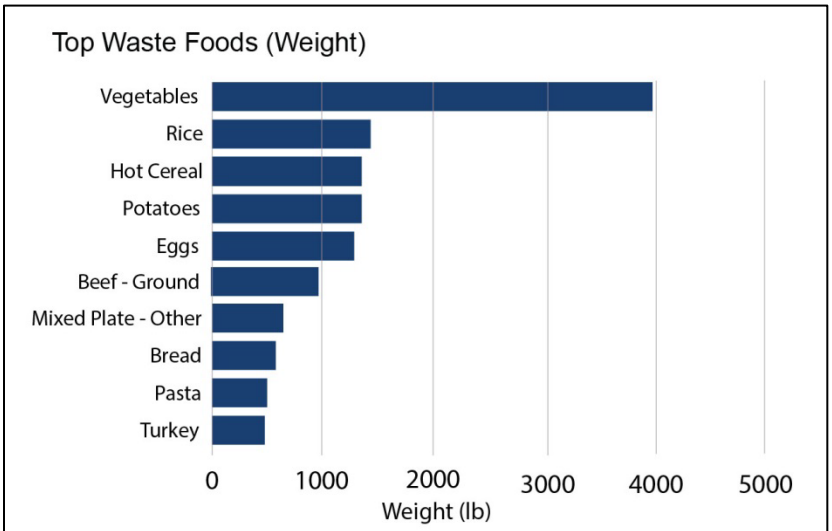

Figure 19 DSA DFACs Top Foods Wasted by Relative Cost

DSA DFAC was able to donate approximately 32%, by weight, of their food waste to a local food bank (Figure 20). It is important to note some user input errors in the disposition of waste—28 pounds of waste were sent to composting even though composting was not available at Fort Jackson (Figure 20).

Overproduction is the primary reason for waste in the DSA DFAC (Figure 21). Unlike the AIT DFAC, DSA DFAC did not think field exercises were a major cause of waste. Instead, they suspect overproduction is likely because NCOs have a choice of where to eat so it is very difficult to attribute the missed meals to any one specific cause.

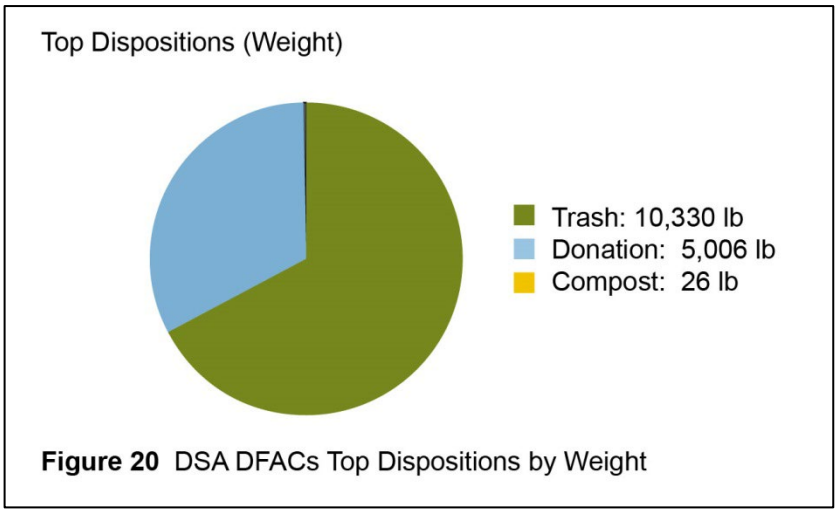

Figure 20 DSA DFACs Top Dispositions by Weight

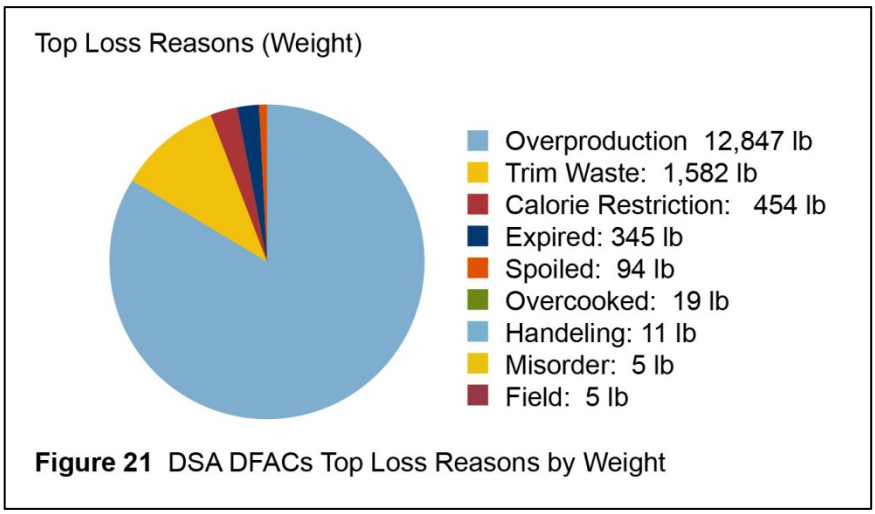

Figure 21 DSA DFACs Top Loss Reasons by Weight

Conclusions / Recommendations

The pilot demonstration of the Leanpath system was a success based on the measured reduction of 3,554 pounds of food waste over three months, and because the staff at Fort Jackson found the system easy to use and of great benefit. Everyone interviewed stated that they would like to keep the systems. Ms. Morrell and Dr. Warren stated that they would like to install systems in the other DFACs on base.

The application of Leanpath data has allowed management of the DSA DFAC to adjust their operations. This unexpected and major accomplishment and will lead to a substantial reduction in food waste going forward, with or without a Leanpath system. It is also believed that even without the Leanpath systems, kitchen staffs are more aware of food waste and the DFACs will continue to operate in a more efficient manner. It remains to be seen if this is a change in culture (e.g., changes will stay through staff turnover), or if this change will only affect those who have experience using the Leanpath system.

The location of the system has a real impact on its effectiveness and its acceptance by kitchen staff. In the DSA DFAC, the system was located right next to their normal waste station. This led to very low impact to normal operations according to staff comments. In the AIT DFAC, due to a lack of power outlets, the system was placed around the corner from the normal waste station where power outlets were accessible. The result was staff had to carry trays of waste around the corner, weigh the waste, and then carry it where it would ultimately be disposed. To alleviate some of this, garbage bins were placed next to the scale but that did not help with waste disposed of via in-sink grinders or placed in hot boxes to be donated to the local food bank.

To better evaluate the effectiveness of a Leanpath system across all sizes of DFACs, it is recommended that a pilot be conducted at a larger DFAC such as one of the basic training DFACs which serve approximately 2 to 3 times the number of meals per service. This currently is working through contractual and funding issues.

Based on the results of this pilot demonstration, we have the following suggestions for initial consideration:

1) It is shown that measuring waste teaches kitchen line staff, chefs, and managers the extent and cost of food waste. This pilot has shown that data on types and timing of waste production are valuable tools toward waste reduction.
2) Conduct a longer-term pilot at additional DFACs. Our initial short-term pilot suggests over production for serving lines is the biggest cause of waste. A more definitive analysis could indicate if:
    a. progressive cooking along with reducing the number of options toward the end of meal time will reduce over production.
    b. increased communication with training staff regarding the timing of field exercises would help DFACs prepare the appropriate number of meals.
    c. improved communication with the nutrition staff on the number of soldiers on various diet restrictions might help DFACs prepare appropriate quantities of food.
3) Encourage nutritionists and chefs to plan to use anticipated leftovers in future meals (e.g., today's leftover hamburgers can become tomorrow's chili). Freeze unserved food, particularly meat, vegetables, and other high dollar foods, and incorporate them in future meals.
4) Continue to coordinate with local groups for food donations, perhaps freezing unserved meals.

References

[1] United States 2030 Food Loss and Waste Reduction Goal: https://www.epa.gov/newsreleases/trump-administration-launches-winning-reducing-food-waste-initiative, accessed 9 August 2019; https://www.epa.gov/sustainable-management-food, accessed 9 August 2019; https://www.epa.gov/sustainable-management-food/united-states-2030-food-loss-and-waste-reduction-goal, accessed 9 August 2019.

[2] Buzby, J.C., and J. Hyman. 2012. Total and per capita value of food loss in the United States. Food Policy, 37:561-570.

[3] Kantor, L.S., K. Lipton, A. Manchester, and V. Oliveira. 1997. Estimating and Addressing America's Food Losses. Food Review/ National Food Review, United States Department of Agriculture, Economic Research Service, 20(1):1-11.

[4] Birney, C.I., K.F. Franklin, F.T. Davidson, and M.E. Webber. 2017. An assessment of individual foodprints attributed to diets and food waste in the United States. Environmental Research Letters, 12:105008.

[5] Buzby, J.C., H.F. Wells, and J, Hyman. 2014. The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States. Economic Information Bulletin, Number 121, iii+33 pp.

[6] "A ROADMAP TO REDUCE U.S. FOOD WASTE BY 20 PERCENT" ReFED 2016; https://www.refed.com/resources, accessed 9 August 2019.

[7] Methane Emissions from Landfills https://www.epa.gov/lmop/basic-information-about-landfill-gas, accessed 9 August 2019.

[8] Office of the Assistant Secretary of the Army. 2011. The Army's Net Zero Initiative. https://www.asaie.army.mil/Public/ES/doc/revised_Updated%20NZ%20White%20Paper%2030%20Oct%202013.pdf, accessed 9 August 2019.

[9] Derquia, B., and V. Fernandez. 2017. The opportunity of tracking food waste in school canteens: Guidelines for self-assessment. Waste Management, 69:431-444.

[10] Leanpath, https://www.leanpath.com/, accessed 9 August 2019.

[11] IKEA Aims to Cut Food Waste By 50% With New Food is Precious Initiative; http://blog.leanpath.com/ikea-food-waste-initiative, accessed 9 August 2019.

[12] Promoting Sustainability through Net Zero Strategies; https://www.asaie.army.mil/Public/ArmyPowerEnergy/NetZero.html, accessed 9 August 2019; https://www.epa.gov/water-research/promoting-sustainability-through-net-zero-strategies, accessed 9 August 2019.