Original Research

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Ways to Reduce Restaurant Industry Food Waste Costs

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Abstract

Food waste costs U.S. restaurant leaders billions of dollars per year. The purpose of this research was to provide restaurant leaders with processes and strategies to reduce food waste costs. The research method used was systematic literature review in addressing this research question: What processes and strategies are available to U.S. restaurant leaders to reduce food waste costs? This study addresses a gap in literature related to processes and strategies to reduce food waste costs. Six processes and seven strategies to reduce food waste costs were presented.

Introduction

Food waste is solid or liquid food substance, raw or cooked, which is discarded, or intended or required to be discarded (Food Waste Reduction Alliance, 2016). Food waste includes the organic residues (such as carrot or potato peels) generated by the processing, handling, storage, sale, preparation, cooking, and serving of food (Food Waste Reduction Alliance, 2016). Approximately $100,000 from each $1 million spent on consumer food purchases results in restaurant waste (Christ & Burrit, 2017; Massow & McAdams, 2015). Approximately one third of consumable food produced annually is discarded, lost, or degraded all stages in the food supply chain (Gollnhofer, 2017; Kowalska, 2017; Liljestrand, 2017). The estimated economic cost of energy, fuel, water scarcity, labor, commodities, and miscellaneous for food waste is estimated as $2.6 trillion per year (The Food and Agriculture Organization of the United States [FAO], 2014). Of this waste, the restaurant industry generated approximately 33 lb of food waste per $1,000 of a restaurant's revenue (Juvan et al., 2018). Researchers have focused on plate-waste based on nutritional factors rather than ways to reduce food waste cost in restaurants (Massow & McAdams, 2015). Elango and Wieland (2015), Massow and McAdams (2015), and Maze (2017) noted that restaurant leaders need processes and strategies to reduce food waste costs.

Statement of the Problem and Purpose

The problem to be addressed was that U.S. restaurant leaders lack processes and strategies to reduce food waste costs. Approximately one third of consumable food produced annually in the United States spoils before consumption (Kowalska, 2017). An estimated $162 billion of food generated in restaurants is wasted yearly (U.S. Department of Agriculture, 2017). Reducing food waste costs to half would reduce food waste by 22% per year (Lipinski, 2013)**.** The purpose of this qualitative study was to explore processes and strategies to reduce food waste costs. It is hoped restaurant leaders can reduce food waste costs and might be able to increase profits, create more jobs, offer affordable prices to customers, and contribute to a cleaner environment in their local communities.

Significance of Research

An estimated 10% of the U.S. workforce is employed in the restaurant industry (National Restaurant Association, 2017b; Rethink Food Waste Through Economics and Data [ReFED], 2017). Reducing food waste costs could increase jobs by 15,000 per year, decrease consumers' expenses for food, and increase consumer satisfaction (Kowalska, 2017; ReFED, 2017; Salam et al., 2016). Restaurant leaders having processes and strategies to reduce food waste costs could improve the U.S. food system proficiency leading to an increase in profit margin and employment. Furthermore, reducing food waste could improve the environmental concerns related to methane gas emissions from landfills and conserve water and biodiversity (Environmental Protection Agency, 2017).

Restaurant leaders could use the results of this study to reduce food waste costs and increase productivity and profitability. Restaurant leaders could use the results to understand the shift in food consumption to regulate food waste costs. U.S. federal agencies might apply these research findings in the development of policies that could adequately regulate food waste leading to reduced food waste costs (Liljestrand, 2017).

Research Question

The primary question driving this research was this: What processes and strategies are available to U.S. restaurant leaders to reduce food waste costs?

Literature Review

The State of Food Waste

Irani and Sharif (2016) argued that the current production of food has led to a shift in higher portions of meat and poultry leading to obesity and higher rate levels of plate waste. Researchers disputed that the increase in plate waste has a behavioral relationship between social norm, culture, and economic value (Cornil & Chandon, 2016; Juvan et al., 2018). Irani and Sharif (2016) noted that food demand, especially in meat and vegetable oils, would increase by 2030 as about 3 billion additional people will enter the middle class. Higher intake of meat leads to higher levels of greenhouse gas emissions as animal protein uses 11 times more fossil fuel and water than vegetables (Cohen & Story, 2014). The increase of food demand opens a debate on how food is produced, distributed, and consumed, especially when food waste continues to grow resulting in a financial, social and environmental burden (Christ & Burritt, 2017; Irani & Sharif, 2016; Mandyck & Schultz, 2015).

In the United States, approximately 133 billion lb of food annually gets discarded, lost, or degraded thought all the stages in the food supply chain totaling 141 trillion calories lost (Gollnhofer, 2017; Kowalska, 2017). Pearson and Perera (2018) added that although the United States experience food waste on all levels of the food supply chain, most of the waste occurs at the retail and individual levels. Researchers noted that the

average consumer generates approximately 0.05 to 1 lb of food waste daily or over 200 lb per capita yearly (Christ & Burritt, 2017; Massow & McAdams, 2015). Higher levels of food waste in the United States occurs due to abundance and higher portions at lower prices (Pearson & Perera, 2018). Researchers posited that higher portions at lower costs increased plate waste by 135% (Juvan et al., 2018; Mirosa et al., 2016).

Food Waste in the U. S. Food Service Industry

The food service industry is a significant source of economic growth and job creation in the United States (ReFED, 2017; Self et al., 2015). Researchers at the National Restaurant Association (2017a) reported that there are over 1 million restaurant locations in the United States with projected sales totaling to 4% of the U.S. Gross Domestic Product along with employing an estimated 10% of the U.S. workforce. Researchers observed that 4% to 10% of food purchased by restaurant leaders never gets to the customer totaling approximately $1000 of the company's revenue per 3.3 lb of food waste (Christ & Burritt, 2017; Massow & McAdams, 2015; Mirosa et al., 2016). Approximately 31% to 40% of the food served to customers never gets consumed (Vogliano & Brown, 2016). Researchers noted that in the United States, food waste uses 2% of the annual energy for consumption, 70% of the potable water, and 37% of the landmass (Christ & Burritt, 2017). Berkowitz and colleagues (2016) argued that food waste in the food service industry occurs during various stages of the food preparation. Researchers identified these stages as improper storage, kitchen preparation, service, leftovers, and consumer plate waste (Christ & Burritt, 2017; Vogliano & Brown, 2016).

Restaurant Waste Management

Despite the widespread calls to reduce food loss and waste, there is much controversy regarding the dearth of data as to the extent of the problem of high food waste costs, a lack of consensus on why there is food waste, and little evidence on how to reduce food loss and waste successfully across the food supply chain. The economics of policies affecting the efficacy of food loss and waste has not been derived as no foundational integrated economic model of the vertical and loss and waste disposition markets has been developed at the market level (Drabik et al., 2019). Policy priorities depend on multiple and interrelated drivers, the impacts of which can only be determined if an economic framework could be developed that takes into account all the major interactions (Drabik et al., 2019). The underlying policy objective is not food waste per se but the environmental/resource degradation and implications for food security.

There is burgeoning literature on food loss and waste, most of which look at microaspects of behavior. The main body of research on this area has consisted mainly of the identification, through qualitative analyses, of the potential behaviors that can somehow be related to food waste (Bernstad & La Cour Jansen, 2011; Schott & Anderson, 2015). Consumers' attitudes towards and awareness of high food waste costs has also been explored by surveys and studies based on the theory of planned behavior (Graham-Rowe et al., 2015; Russell et al., 2017). Researchers have analyzed the effects of labeling (Wilson et al., 2017), packaging (H. Williams et al., 2012), or the use of large packages and overbuying (Halloran et al., 2014), and plate waste (Lorenz et al., 2017). Compared to the tons of waste generated, an optimal waste management strategy is lacking in the United States.

Portion Sizes

Bematech (2019) noted the biggest factor in reducing food waste costs is controlling portion sizes. Lipinski et al. (2013) stated that restaurant leaders need to reduce food portion sizes to lower food waste. Food waste occurs within the restaurant as larger portions increase the likelihood customers will not eat all of food on the plate (Behmen-Milicevic, 2019). Reducing portion sizes in direct and indirect ways can decrease food waste and save money for restaurant leaders. Food portion sizes in United States have increased since the 1970s (Lipinski et al., 2013). Restaurants use larger portion sizes as selling points to suggest to customers that customers are receiving a bargain for the food purchase. In the United States, restaurants consistently offer

portion sizes that are two to three times what the average customer should be consuming in a meal (Lipinski et al., 2013). The trend toward larger portion sizes appears to be a primary reason more food is wasted increasing the food waste costs for restaurant leaders (Lipinski et al., 2013). Larger portion sizes are a contributing factor to the increasing obesity rates in the United States (Herman et al., 2016). U.S. diners do not finish 17% of the food provided on the plate and leave 55% of the food purchased behind resulting in approximately 9% of food purchased at the restaurant is disposed of at the restaurant (Lipinski et al., 2013). Resnick and Belluz (2018) noted that consumers given larger bowls took 16% more cereal than those with smaller bowls. Consumers generally find a 70% fill rate to be visually pleasing (Resnick & Belluz, 2018).

Methodological Approach

This study is a qualitative review of the extant literature responding to the research question. The method used to review literature is systematic review. Researchers use systematic review in addressing a specific research question derived from the extant literature (Okoli, 2015; Rajaeian et al., 2017). In a systematic review, researchers seek to search for, appraise, and synthesize research evidence focused on and exhaustive and comprehensive search primarily of peer reviewed articles (Glock et al., 2017).

In a systematic review, the researcher aims to understand what is known and what still is unknown, uncertainty of the findings, recommendations for further research, and recommendation for practice (Glock & Grosse, 2015; Glock et al., 2017). Researchers use systematic review to provide an objective approach toward reducing bias (Bearman & Dawson, 2013). The review helps researchers identify and critically appraise pertinent research by collecting, analyzing, and reporting results from peered and nonpeer-reviewed information (Hochrein et al., 2015).

Of the 55 resources used in this article, 36 (65%) came from peer-reviewed published articles, and 19 (35%) came from books and websites. Criteria for inclusion and exclusion of resources focused on the research question and available resources. Articles, books, and authoritative websites written in English pertaining to processes and strategies to reduce food waste costs published between 2003 and 2019 were included. Included studies were considered acceptable contingent upon research conducted and analyses provided with representative and reasonable sample size meeting reliability and validity criteria published with major academic outlets whenever possible (Glock & Grosse, 2015; Glock et al., 2017). I used government research and academic literature review to critique, evaluate, and explain food waste in the restaurant setting. I searched business and management databases to synthesize peer-reviewed articles. Specific databases for this study included EBSCOhost; *Emerald Management Journal*; ProQuest; Science Direct; Sage Premier; government databases such as FAO, Environmental Protection Agency, and Department of Agriculture; and textbooks. Google Scholar was also used. Websites, blogs, wikis, articles not written in English, and articles outside the focus of the research question were excluded.

Five steps exist in systematic review. First, the researcher frames the research question(s) for review (Khan et al., 2003; Knoll et al., 2017). For this study, the research question is this: What processes and strategies are available to restaurant leaders to reduce food waste costs? Key terms used were *restaurants*, *restaurant strategies*, *restaurant processes*, *food waste*, *food loss*, and *restaurant food waste costs*. Key terms were identified by a review of the literature. The second step is to find relevant studies (Khan et al., 2003; Knoll et al., 2017). For this study, academic resources were accessed from (a) EBSCOhost, (b) ProQuest, (c) ScienceDirect, (d) Academic Search, (e) ABI/INFORM, (f) Emerald, (g) Springer, (h) SAGE Journals, (i) John Wiley and Sons, and (j) Taylor and Francis.

The third step is to assess the quality of the studies (Khan et al., 2003; Knoll et al., 2017). Journals used in this article were assessed under the assumption the peer-review process is a reliable indicator that the literature review, research methods, threats to validity, and the accuracy of reporting of findings/results were addressed

and are acceptable by a thorough examination of at least two independent experts in the same field. I reviewed as many peer-reviewed articles as possible to collect data to minimize bias. Researcher bias and confirmation bias were assessed as potential threats in this article. Researcher bias was mitigated by identifying inclusion processes and strategies to reduce food waste costs. Confirmation bias was a threat to article retrieval and data analysis because I could have a specific belief on processes and strategies to reduce food waste costs. To mitigate confirmation bias, I continually reevaluate impressions from data presented in the articles and challenged my preexisting assumptions.

The fourth step is to summarize the evidence (Khan et al., 2003; Knoll et al., 2017). Evidence was derived from the extant literature. No primary data were collected for this study. The search strategy was to use databases such as (a) EBSCOhost, (b) ProQuest, (c) ScienceDirect, (d) Academic Search, (e) ABI/INFORM, (f) Emerald, (g) Springer, (h) SAGE Journals, (i) John Wiley and Sons, and (j) Taylor and Francis. Quantitative, qualitative, and mixed-methods articles were included. Some nonpeer-reviewed articles were selected when relative peered articles were unavailable. Articles and books that did not pertain to processes and strategies to reduce food waste costs were not included.

The fifth step is to interpret findings (Khan et al., 2003; Knoll et al., 2017). An interpretation of findings is offered in the results section. Data were analyzed and synthesized from the extant literature. As outlined in the research literature and in the rest of this article, an indication in the literature is to reduce food waste costs and might be able to increase profits, create more jobs, offer affordable prices to customers, and contribute to a cleaner environment in their local community. It is expected the literature review will provide sufficient information to respond effectively to the research question.

The primary limitation of this study was scant extant research exists identifying processes and strategies to reduce food waste costs. This limitation was ameliorated by the use of research available pertaining to restaurant food waste costs. The second limitation was in not using primary data collection methods used such as interviews, surveys, and questionnaires. Processes and strategies are available to U.S. restaurant leaders to reduce food waste costs is unexplored and underexplored therefore the likelihood restaurant leaders would be able to sufficiently address the research question was deemed nil. The third limitation was that the selection of the main research databases related to the topic. I am unable to guarantee all processes and strategies are available to U.S. restaurant leaders to reduce food waste costs articles in the extant were selected for review. The fourth limitation was that I did not in applying the systematic literature method perform forward searches due to temporal and resources constraints.

Results

Processes to Reduce Food Waste Costs

Food Loss and Waste Measurement Protocol
Restaurant leaders have options for reducing food waste costs. Lipinski (2013) noted restaurant leaders need to develop a food loss and waste measurement protocol. The protocol could provide restaurant leaders with a standardized way to measure what data sources and quantification methods are appropriate, how to ensure comparability among users over time, how to report results, monitor food loss and waste among other features (Lipinski et al., 2013). As part of the protocol, restaurant leaders should conduct periodic food loss and waste audits comporting to the protocol. By doing so, leaders could quantify how much and where food loss and waste are occurring. Having this information, leaders should be better able to identify where opportunities for food loss and waste reduction might exist, who in the restaurant needs to be engaged to achieve those reductions, what strategies might be appropriate, what targets to set, and how much progress is being made over time. The protocol is applicable to enable consistency, comparability, and transparency for restaurant leaders (Lipinski et al., 2013).

Food Loss and Waste Reduction Targets

Lipinski (2013) suggested restaurant leaders set food loss and waste reduction targets related to time-bound targets which can inspire action by raising awareness, focus attention, and mobilize resources to reduce food loss and food waste. Setting quantifiable, time-bound targets could raise awareness to restaurant leaders, stimulate focused attention to reduce food loss and food waste, and mobilize resources toward reducing food loss and waste. Targets could be adopted across a range of geographic areas and a variety of restaurants (Lipinski, 2013).

Food Waste Inventory System

A food waste inventory system can help restaurant leaders to identify how much and where food is wasted so restaurant staff can implement smaller portions, make menu changes and or offer food substitutions, and monitor progress toward reducing food loss and food waste (Australian Institute of Food Safety, 2019). Lipinski (2013) mentioned automatic tracking of products by lot number and vendor name or number could establish where and how food waste specifically occurs. Leaders are encouraged to leverage technology to control temperature control, implement advanced supply chains, extend shelf life of food, and use devices to trigger notification of expiry dates (Chan, 2019). Knowing food inventory types and volumes can help to manage food inventory to maintain freshness, high quality, improve the efficiency of operations, and to reduce food loss and waste (Chan, 2019).

Predict Food Orders

Restaurant leaders should have a manual or digital system in place to accurately predict food orders and implement predictive ordering technology. By doing so, leaders can have more accurate data, a better understanding of food order patterns, control over kitchen operations, which ultimately can lead to less waste (Australian Institute of Food Safety, 2019). One technology leaders should consider is artificial intelligence (Vogel, 2019). Leaders can use voice assistant-enabled technology such as Amazon Echo or Google Home application programming interfaces to be able to predict food orders. Another is technology is machine learning (Vogel, 2019). For example, leaders could implement applications and solutions such as Cloud Big Data to collect data from customers via food ordering habits and preferences to better predict food orders.

Lipinski et al. (2013) noted implementing a detailed system such as a weight-based system to quantify the amounts of food waste can be effective in reducing food waste. Weight-based systems are highly accurate but require laborious effort by staff and management and physical space in the restaurant (Hanks et al., 2014). Hanks et al. noted visual analysis of waste made at regular intervals might be easier to implement but can only be used to determine patterns of leftover food or overbought foods. Predicting food orders is not widely done used in restaurants (Lipinski et al., 2013). Restaurant leaders generally do not have the time available to implement manual or digital system tracking tools to improve their business operations by predicting food orders (FAO, 2014).

Reduced Portion Sizes

One process for reducing food waste would be for restaurant leaders to offer smaller portion sizes at a lower price while still offering larger portion sizes at a higher price (Behmen-Milicevic, 2019). This would permit customers with smaller appetites to order a smaller meal and presumably leave less behind, while also lowering preparation and food waste costs for the restaurant. This process could also be a relatively small adjustment for the many restaurants as many restaurants offer children's menus with smaller portion sizes.

Another process is for restaurant leaders to examine how much and what types of food tends to be left on customers' plates. By doing this type of analysis, restaurant leaders can make modifications accordingly to and reduce food waste. Behmen-Milicevic (2019) suggested to reduce portions of food is to reduce the size of plates. Restaurant leaders should invest in a new dinner service process. One process is to offer smaller plates and glasses thereby reducing portion size. Behmen-Milicevic recommended setting smaller plates with food on larger plates. In this way, portions will look bigger.

Reduce Preconsumer Waste

Bematech (2019) noted restaurant leaders continually search for ways to reduce food waste. Leaders need to determine how much food is actually being wasted and where the waste is coming from. Bematech suggested using sales data from the point-of-sale system to observe customer food traffic in the restaurant and to evaluate to how much food is being wasted. Once these data have been gathered, food waste should focus on the preconsumer. Restaurant leaders can determine pre-consumer waste by adopting the first-in/first-out inventory method (Lipinski et al., 2013). The first-in/first-out method can help to ensure that older food items are used first before spoilage (Bematech, 2019). Another preconsumer process is not to over prepare food. Bematech noted that restaurant staff begins preparing food for the day in large batches leading to food waste if the entire batch is not used. While it can be difficult to use manual methods to accurately forecast needs, leaders can review data from the point of sale to determine how much is actually being used on a daily basis versus how much is being prepared. In this way, kitchen staff can determine which items to prep for the day's business. Restaurant leaders need to monitor which typed of food are being wasted more often than others, and how much of each dish is being wasted. Leaders need to reduce portions to match what the average customer is actually consuming.

Strategies to Reduce Food Waste Costs

Regularly Rotate the Food in the Refrigerator

Behmen-Milicevic (2019) mentioned that foods to be used first need to be in the front of the refrigerator. Behmen-Milicevic recommended storing food in the refrigerator using the "right to left" rule. This means that newly purchased foods should be stored on the right side of the fridge while existing food need to be moved further to the left (Behmen-Milicevic, 2019). When prepping food, staff should reverse the order from "left to right." In this way, the food is more likely to be fresh thereby reducing food waste.

Use Software for Inventory Management

Restaurant leaders need to conduct inventory to help reduce food waste costs. Leaders can use restaurant software such as Lavu, Loyverse, or Upserve to help conduct inventory (Brophy, 2019). By using inventory software, leaders can have insight into what is consumed daily and are able to identify the optimal time to purchase. Leaders can use inventory software to correct inventory items and to record expenses in cases where the goods have to be disposed of as a waste due to improper storage or expiration date (Behmen-Milicevic, 2019). Leaders who frequently conduct inventory can avoid spoilage of foods and food waste costs.

Restaurant Waste Recycling

Behmen-Milicevic (2019) suggested development of a recycling system for all types of restaurant waste. Recycling of restaurant waste has become a part of daily work for 65% of restaurant leaders in the United States (Behmen-Milicevic, 2019). Behmen-Milicevic noted that food waste is organic and can be recycled. Restaurant leaders can contract with a local company for recycling. In this way, restaurant leaders can earn additional revenue from waste. Leaders should also purchase products made from recycled materials. Sindhu et al. (2019) mentioned most food waste goes to the local landfill or for generation of conventional energy. Food wastes are biodegradable and contain high moisture hence suitable for the production of bioenergy by anaerobic digestion (Sindhu et al., 2019)

Implement Reusable Items

K. Williams (2018) suggested starting to use items in restaurants that can be sanitized and reused such as using cloth napkins over paper ones or silverware instead of plasticware. Leaders should encourage customers not to use straws, rather to bring their own straws, or to only provide straws when requested (K. Williams, 2018). Leaders can encourage customers to bring their own containers for leftover food or even sell reusable containers to lower food waste costs and increase revenue.

Strategies to Achieve Food Waste Reduction

Measure

Clowes and colleagues (2019) noted conducting a quantification of food waste generated food waste inventories that can enabled restaurant leaders to identify how much and where food is being wasted. This strategy can help leaders prioritize critical areas to tackle and monitor progress over time. Clowes et al. recommended that leaders who want detailed data analysis to use digital tools and software to measure food waste. Manual measurement systems provide leaders with a basic overview of where food waste occurs (Clowes et al., 2019). However, manual measurement systems tend to underreport waste and may not capture all opportunities to reduce waste. Accurate measurement of food waste using smart scales can give leaders better control over their kitchens and a better understanding of food order patterns.

Engage Staff

Clowes et al. (2019) noted kitchen and service staff members often want to help prevent food waste but need more definition and guidance from leadership. This guidance, for example, could come in the form of daily staff meetings, casual conversations, formal training, or even peer learning opportunities. Leadership should also work to remove any perception of blaming staff for causing waste. If staff fears they will be blamed for wasting food, rather than rewarded for measuring it, staff engagement will likely decline. Clowes et al. noted that the most innovative ideas for reducing a kitchen's waste come from kitchen staff themselves, not from management or leadership. Leaders need to encourage kitchen staff to develop creative and effective strategies to combat waste and encourage collaboration within the restaurant such as pilot programs and cross-site peer learning opportunities (Australian Institute of Food Safety, 2019). Leaders should also build rewards into a food waste reduction program to drive desired behavior change and engagement among staff (Australian Institute of Food Safety, 2019).

Reduce Overproduction

Clowes et al. (2019) offered that routinely overproducing food can result in high levels of waste as this overproduced food cannot always be repurposed in a different way. While spoiled food or returned orders can contribute to restaurant food waste, leaders who focus on overproduction can reap the most rewards for the least cost. Certain production techniques contribute to a culture of overproduction (Australian Institute of Food Safety, 2019). Restaurant leaders can save time and money by reducing overproduction but often fail to consider the hidden costs of food waste such as utility use as in electricity and water and added cost of labor in food preparation (Clowes et al., 2019).

Discussion

Lipinski et al. (2013) noted food waste research is an emerging subdiscipline of waste research. The complexity of the problem arises from the diverse food production economy, which has a multitude of interactions among suppliers, consumers, managers, and waste management operators. However, collaboration among different stakeholders is not yet sufficient and more effort is needed to decrease the impacts of food waste Because of the high cost associated with food waste restaurant leaders need to be educated on the potential impacts of processes and strategies that are available to U.S. restaurant leaders to reduce food waste costs. In this research, I provided information related to processes and strategies that are available to U.S. restaurant leaders to reduce food waste costs. I answered the following research question: What processes and strategies are available to U.S. restaurant leaders to reduce food waste costs? My findings indicated restaurant leaders need to (a) use a food loss and waste protocol, (b), use food reduction targets, (c), use a food waste inventory, (d), predict food orders, (e) reduce portion sizes, (f) rotate food in the refrigerator, (g) recycle, (h) reuse items, and (i) reduce food waste strategies. It is hoped that restaurant leaders will reduce

food costs and generate greater revenue. By doing so, employee morale may increase and environment impacts lowered.

Regarding future research, I recommend follow-up qualitative research asking restaurant owners strategies used to increase productivity or gain competitive advantage. Researchers should consider qualitative research by conducting interviews of restaurant owners to understand whether restaurant leaders are open to or use the findings from this study when seeking to reduce food waste cost. Quantitative researchers should consider examining whether a relationship exists between reduction in food waste costs and productivity.

References

Australian Institute of Food Safety. (2019). *10 Ways to reduce food waste in restaurants*. https://www.foodsafety.com.au/blog/10-ways-reduce-food-waste-restaurants

Bearman, M., & Dawson, P. (2013). Qualitative synthesis and systematic review in health professions education. *Medical Education, 47*, 252–260. https://doi.org/10.1111/medu.12092

Behmen-Milicevic, A. (2019). *16 Tips for Restaurant Food Waste Reduction*. https://possector.com/management/restaurant-food-waste-reduction

Bematech. (2019). *Ways to reduce food waste in restaurants*. http://bematechus.com/blog/2019/02/ways-to-reduce-food-waste-in-restaurants/

Berkowitz, S., Marquart, L., Mykerezi, F., Degeneffe, D., & Reicks, M. (2016). Reduced-portion entrées in a worksite and restaurant setting: impact on food consumption and waste. *Public Health Nutrition, 19*, 3048-3054. https://doi.org/10.1017/S1368980016001348

Bernstad, A., & La Cour Jansen, J. (2011). A life cycle approach to the management of household food waste: A Swedish full-scale case study. *Waste Management, 31,* 1879–1896. https://doi.org/10.1016/j.wasman.2011.02.026

Brophy, M. (2019). *6 Best restaurant inventory management software 2019*. https://fitsmallbusiness.com/restaurant-inventory-management-software/

Chan, M. (2019). *How to reduce your food inventory waste*. https://www.unleashedsoftware.com/blog/how-reduce-food-inventory-waste

Christ, K. L., & Burritt, R. (2017). Material flow cost accounting for food waste in the restaurant industry. *British Food Journal, 119*, 600–612. https://doi.org/10.1108/bfj-07-2016-0318

Clowes, A., & Hanson, H., & Swannell, R. (2019). Th*e business case for reducing food loss and waste: Restaurants*. http://www.refreshcoe.eu/resources/the-business-case-for-reducing-food-loss-and-waste-restaurants/

Cohen, D. A., & Story, M. (2014). Mitigating the health risks of dining out: The need for standardized portion sizes in restaurants. *American Journal of Public Health, 104,* 586–590. https://doi.org/10.2105/ajph.2013.301692

Cornil, Y., & Chandon, P. (2016). Pleasure as an ally of healthy eating? Contrasting visceral and Epicurean eating pleasure and their association with portion size preferences and wellbeing. *Appetite, 1*, 104–152. https://doi.org/10.1016/j.appet.2015.08.045

Drabik, D., deGorter, H., Reynolds, C. (2019). A conceptual and empirical framework to analyze the economics of consumer food waste. *Resources, Conservation & Recycling, 149*, 500–509. https://doi.org/10.1016/j.resconrec.2019.06.008

Elango, B., & Wieland, J. R. (2015). Impact of country effects on the performance of service firms. *Journal of Service Management, 26*, 588–607. https://doi.org/10.1108/JOSM-02-2015-0056

Environmental Protection Agency. (2017). *Environmental Information Exchange Network (EIEN).* https://www.epa.gov/

Food and Agriculture Organization (FAO). (2014). *Food waste footprint: Full-cost accounting.* http://www.fao.org

Food Waste Reduction Alliance. (2016). *Analysis of the U.S. food waste among food manufacturers, retailers, and restaurants.* https://www.foodwastealliance.org/wpcontent/uploads/2014/11/FWRA_BSR_Tier3fFINAL.pdf

Glock, C. H., & Grosse, E. H. (2015). Decision support models for production ramp-up: A systematic literature review. *International Journal of Production Research, 53*, 663–6651. https://doi.org/10.1080/00207543.2015.1064185

Glock, C. H., Grosse, E. H., & Ries, J. M. (2017). Decision support models for supplier development: Systematic literature review and research agenda. *International Journal of Production Economics, 193*, 79–-812. https://doi.org/10.1016/j.ijpe.2017.08.025

Gollnhofer, J. F. (2017). Normalizing alternative practices: The recovery, distribution and consumption of food waste. *Journal of Marketing Management, 33*, 624–643. https://doi.org/10.1080/0267257x.2017.1301982

Graham-Rowe, E,. Jessop, D., C., & Sparks, P. (2015). Predicting household food waste reduction using an extended theory of planned behavior. *Resources, Conservation and Recycling, 101*, 194–202. https://doi.org/10.1016/j.resconrec.2015.05.020

Halloran, A., Clement, J., Kornum, N., Bucatariu, C., & Magid, J. (2014). Addressing food waste reduction in Denmark. *Food Policy 49*, 294–301. https://doi.org/10.1016/j.foodpol.2014.09.005

Hanks, A. S., Just, D. R., & Wansink, B. (2014). Chocolate milk consequences: A pilot study evaluating the consequences of banning chocolate milk in school cafeterias. *PLOS One, 9*, e91022. https://doi.org/10.1371/journal.pone.0091022

Herman, C. P., Polivy, J.. Vartanian, L. R., & Pliner, P. (2016). Are large portions responsible for the obesity epidemic? *Physiology & Behavior, 156*, 177–181. https://doi.org/10.1016/j.physbeh.2016.01.024

Hochrein, S., Glock, C. H., Bogaschewsky, R., & Heider, M. (2015). Literature reviews in supply chain management: A tertiary study. *Management Review Quarterly, 65*, 239–280. https://doi.org/10.1007/s11301-015-0113-4

Irani, Z., & Sharif, A. M. (2016). Sustainable food security futures. *Journal of Enterprise Information Management, 29*, 171–178. https://doi.org/10.1108/jeim-12-2015-0117

Juvan, E., Grün, B., & Dolnicar, S. (2018). Biting off more than they can chew. *Journal of Travel Research*, *57*, 232–242. https://doi.org/10.1177/0047287516688321

Khan, K. S., Kunz, R., Kleijnen, K., & Antes, G. (2003). Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine, 96*, 118–121. https://doi.org/10.1258/jrsm.96.3.118

Knoll, T., Omar, M. I., Maclennan, S., Hernandez, V., Canfield, S, Yuan, Y., … Sylvester, R. (2017). Key steps in conducting systematic reviews for underpinning clinical practice guidelines. Methodology of the European Association of Urology. *European Urology*, 73, 290–300. https://doi.org/10.1016/j.eururo.2017.08.016

Kowalska, A. (2017). The issue of food losses and waste and its determinants. *Logforum, 13*, 7–18. https://doi.org/10.17270/J.LOG.2017.1.1

Liljestrand, K. (2017). Logistics solutions for reducing food waste. *International Journal of Physical Distribution & Logistics Management, 47*, 318–339. https://doi.org/10.1108/ijpdlm-03-2016-0085

Lipinski, B. (2013). *10 Ways to cut global food loss and waste*. https://www.wri.org/blog/2013/06/10-ways-cut-global-food-loss-and-waste

Lipinski, B., Hanson, C., Lomax, J., Kitinoja, L., Waite, R., & Searchinger, T. (2013). *Reducing food loss and waste*. https://www.wri.org/publication/reducing-food-loss-and-waste

Lorenz, B., Hartmann, M., Hirsch, S., Kanz, O., Langen, N. (2017). Determinants of plate leftovers in one German catering company. *Sustainability, 9*, 807–824. https://doi.org/10.3390/su9050807

Mandyck, J. M., & Schultz, E. B. (2015). Food foolish: *The hidden connection between food waste, hunger and climate change*. Carrier Corporation.

Massow, M. V., & McAdams, B. (2015). Table scraps: An evaluation of plate waste in restaurants. *Journal of Foodservice Business Research, 18*, 437–453. https://doi.org/10.1080/15378020.2015.1093451

Maze, J. (2017). *Restaurant sales to hit $799B in 2017*. http://www.nrn.com

Mirosa, M., Munro, H., Mangan-Walker, E., & Pearson, D. (2016). Reducing waste of food left on plates. British Food Journal, 118, 2326–2343. https://doi.org/10.1108/bfj-12-2015-0460

National Restaurant Association. (2017a). *Employing America*. http://www.restaurant.org/

National Restaurant Association. (2017b). *Facts at a glance*. http://www.restaurant.org/

Okoli, C. (2015). A guide to conducting a standalone systematic literature review. *Communications of the Association for Information Systems, 37*, 879–910. https://doi.org/10.17705/1CAIS.03743

Pearson, D., & Perera, A. (2018). Reducing food waste: A practitioner guide identifying requirements for an integrated social marketing communication campaign. *Social Marketing Quarterly, 24,* 45–57. https://doi.org/10.1177/1524500417750830

Rajaeian, M. M., Cater-Steel, A., & Lane, M. (2017). A systematic literature review and critical assessment of model-driven decision support for IT outsourcing. *Decision Support Systems, 102,* 42–56. https://doi.org/10.1016/j.dss.2017.07.002 0167-9236

Resnick, B., & Belluz, J. (2018). *A top Cornell food researcher has had 15 studies retracted: That's a lot*. https://www.vox.com/science-and-health/2018/9/19/17879102/brian-wansink-cornell-food-brand-lab-retractions-jama

Rethink Food Waste Through Economics and Data (ReFED). (2017). *An economic analysis of food waste solutions*. http://www.refed.com/

Russell, S. V., Young, C. W., Unsworth, K. L., & Robinson, C. (2017). Bringing habits and emotions to food waste behavior. *Resources, Conservation and Recycling. 125*, 107–114. https://doi.org/10.1016/j.resconrec.2017.06.007

Salam, A., Panahifar, F., & Byrne, P. (2016). Retail supply chain service levels: The role of inventory storage. *Journal of Enterprise Information Management, 29*, 887–902. https://doi.org/10.1108/jeim-01-2015-0008

Schott, A. B. S., & Anderson, T. (2015). Food waste minimization from a lifecycle perspective. *Journal. Environmental Management, 147*, 219–226. https://doi.org/10.1016/j.jenvman.2014.07.048

Self, J. T., Jones, M. F., & Botieff, M. (2015). Where restaurants fail: A longitudinal study of micro locations. *Journal of Foodservice Business Research, 18*, 328–340. https://doi.org/10.1080/15378020.2015.1068670

Sindhu, R., Gnansounou, E., Rebello, S., Binod, P., Varjani, S., Shekhar Thakure, I., . . . Pandeyg, A. (2019). Conversion of food and kitchen waste to value-added products. *Journal of Environmental Management, 241*, 619–630. https://doi.org/10.1016/j.jenvman.2019.02.053

U.S. Department of Agriculture. (2017). *Food availability (Per capita) data system.* https://www.ers.usda.gov/

Vogel, P. (2019). *McDonald's is using AI to predict your order before you show-up*! https://www.foley.com/en/insights/publications/2019/10/mcdonalds-using-ai-to-predict-your-order

Vogliano, C., & Brown, K. (2016). The state of America's wasted food and opportunities to make a difference. *Journal of the Academy of Nutrition and Dietetics, 116*, 1199–1207. https://doi.org/10.1016/j.jand.2016.01.022

Williams, H., Wikström, H. F., Otterbring, T., Löfgren, M., & Gustafsson, A. (2012). Reasons for household food waste with special attention to packaging. *Journal of Cleaner Production, 24,* 141–148. https://doi.org/10.1016/j.jclepro.2011.11.044

Williams, K. (2018). *How to reduce restaurant waste*. https://www.shopkeep.com/blog/how-to-reduce-restaurant-food-waste#step-1

Wilson, N. L., Rickard, B., Saputo, R., & Shuay-Tsyr, H. (2017). Food waste: The role of date labels, package size, and product category. *Food Quality and Preference 55,* 35–44. https://doi.org/10.1016/j.foodqual.2016.08.004