

## Food Waste Management: Exploratory Study of Egyptians chefs

Shimaa Abo Elsoad Mohamed Soliman

The Higher Institute for Tourism, Hotels & Computer El-Seyouf, Alexandria, Egypt

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### Abstract

Food waste has recently become one of the most common problems facing the hospitality sector. Food waste in the kitchen represents the largest waste stream in a full-service hotel and approximately four to ten percent of food purchased by restaurants becomes kitchen loss, both edible and inedible. It is, however, food waste in the hospitality sector that has been excluded from attention. This study provides critical literature of kitchen food waste according to chefs' viewpoint in Alexandria Governorate -Egypt hotels. The study aims to evaluate practices implemented in kitchens; moreover, increase awareness among kitchen staff with the dangers of excessive food waste. The study also discusses the application of smart food waste management systems in kitchens and finally, recommends some effective practices for effect food waste reduction. In order to achieve these objectives, 300 questionnaire forms are distributed separately and by mail to professional kitchen staff in all types of hotels. The returned and valid forms were (253) forms with a percentage rate (84.3%). Data were described using mean, standard deviation, Pearson coefficient correlation, Spearman coefficient. The study highlights the lack of awareness among kitchen staff towards food waste issues, due to which management actions were taken by the managers.

### Introduction

Since, the 1980s, the tourism industry has started to take environmental issues and thoughts of sustainable tourism vitally. The hospitality industry has been in the front position of the development of environmental-friendly operation management (Swarbrooke, 1999). Waste management started to change from a just pollution avoidance and control practices, towards a more comprehensive tactic. The energy, labor, soil, water and other inputs used to grow, manufacture, distribute and prepare food are lost with each kilogram that is thrown away (Stuart, 2009; Hogg, Wilson, Gibbs, Holmes, & Eve 2010). Appropriate waste management is recognized as a vital requirement for sustainable development (UNHSP, 2010; UNEP, 2011). Food waste has emerged as one of the world's most critical human-green issues. One-third of global food (1.3 billion) tons of food is mislaid from production to consumption, with significant variation by region (Gustavsson, Cederberg, Sonesson, Van Otterdijk, and Meybeck 2011). Food waste is a chief international challenge (World Food Programme, 2014). Additionally, food waste is the number one waste management trouble for hotels around the globe (Epler, 2017).

In Egypt, solid wastes are collected of (60%) organic waste, (10-25%) papers, (3-12%) plastic wastes, (1.5-7%) mineral wastes, (1.2-7) % clothes wastes, and (3%-11) % other wastes (Egypt state environmental service,2009). The emerging economies in Egypt highly suffer from production and transportation food losses. As an illustration, there are 3,400 calories available per inhabitant every day in Egypt; but about 1,200 calories, or about 35%, is lost to post-production food waste. While 64% of the diet of Egyptians is based on cereals, up to 20% of grains are lost by weight. For meat, that number is 13% and 17% for potatoes; as for tomatoes, the loss can be as high as 43% of all tomatoes produced (Egyptian Chef Association,2014).

The growth of population is one of the main reasons for increasing waste's quantity, where the increase in population during the period from 2006 to 2017 is about 2,7% compared to the rate of 2,4% during the period from 1996 to 2016 and the amount of waste produced is also increased. The increase in food waste is a problem when it decomposes and produces undesirable gases such as the production of methane, which is the strongest greenhouse gas, which exceeds the effect of the Carbon dioxide (CO<sub>2</sub>) gas in phenomena the global warming. Egypt produces about 90 million tons of solid waste per year; that is daily generation estimated with 55.000 tons and municipal waste are about 20 million tons annually Egypt (Environmental affairs, 2016). According to a study conducted by the Barilla Center for Food and Nutrition (BCFN), Egypt comes in the sixteenth place after Saudi Arabia, United Arab Emirates, and Palestine among others. Egypt scaling the top of the highest contributing countries to food waste percentages with 73 kilograms total annual amount of global food waste per person (Adham, 2017). Alexandria governorate accounts for about 37% of the total waste produced from the governorates of Delta, Beheira, Kafr El Sheikh, Gharbia, Menoufia, Sharkia, Damietta (Egypt Environmental affairs, 2016).

Food waste represents the biggest waste stream in a full-service hotel (Crosby, 1993). Food waste was found making up to 66.5% of hotel waste in mid-scale hotels (Shanklin and Pettay 1993). Approximately four to ten percent of food purchased by restaurants becomes kitchen loss, both edible and inedible (LeanPath, Inc.,2008). Although, one phase of hotel business which is known to create waste is the production and service of food, where the hotel industry generates superior levels of food waste compared to many other kinds of catering operations (Kirk, 2010), fewer studies being carried in areas such as the hospitality sector (Marthinsen *et al.*, 2012). In the study of the UK based Sustainable Restaurant Association (SRA), waste streams from the kitchen and customers were divided. The study was conducted in different restaurants and measured the waste over one day; the average waste per day was around 60 kg, with around 70% from the kitchen (preparation and 5 % spoilage) and 30 % from the customer. The kitchen is the task control for making the most of your food (Hackfurth, 2014).

It's where the magic happens; the slightly soft carrots are reborn as rich carrot soup, the stale bread is transformed into the herbed crust of fish fillet (Gunders, 2015). More than half of the rich world's losses take place in its kitchens (Lomborg, 2015). Additionally, the significance of food waste has only recently been recognized, which results in the existence of literature gaps, (Papargyropoulou, Wright, Lozano, Steinberg, Padfield, Ujang, 2016). Many studies failed to evaluate food waste practices that are applied

among kitchen staff especially in hotels (One to- five) stars in the Alexandria governorate –Egypt. Therefore, this research is needed to identify practices that are being followed in hotels in Alexandria governorate and promote the best professional practices to manage food waste, understand the challenges that faced hotels’ managers for food waste reduction, increase awareness among kitchen staff with the dangers of excessive food waste, discuss the application of smart food waste management system in kitchens and finally, recommend some effective practices for effect food waste reduction.

## **Relevant Literature**

### **Overview of food waste and its impact**

Food waste represents (46%) of the total waste generated in US hotels (Alexander, 2002). Food waste in the UK hospitality industry indicated that (15.5%) of edible food was found to be wasted in restaurants and hotels compared with an average of (11.4%) for the catering industry as a whole (Kirk, 2010). Accordingly, the hospitality sector produces a large quantity of food waste compared to the other solid waste types (Ball and Abou Taleb, 2010). A more recent estimate is that restaurants generate (33%) of the total food waste in the US (BSR 2012).The foodservice industry generates more food waste than the wholesale, retail, and production sectors, respectively (BSR, 2012; Stenmarck, Jensen, Qusted, & Moates, 2016). A survey conducted by the National Restaurant Association of 1,300 chefs found that “food waste reduction” was a “Top 10 Concept Trend” in 2017 (National Restaurant Association, 2016).

Food waste in service institutions can be broadly categorized as kitchen waste which involves wastes that arise during food storage, ingredient preparation, cooking, and serving (Engstrom and Carlsson-Kanyama, 2004). Food wastage is any food lost; thus, the wastage is here used to cover both food loss and waste (Food and Agriculture Organization, 2012). Kitchen wastes are referred to as pre-consumer waste and plate waste as post-consumer food waste or ‘table scraps’ (LeanPath, 2012). Food waste tends to be food that has excellent quality and is appropriate for utilization but does not get consumed because it gets discarded either before or after it is left to perish. (Lipinski, 2013). Food waste can be in the form of solid or liquid food substance, raw or cooked, which is ignored. Food waste involves the organic remains (as carrot or potato peels) arising from the processing, handling, storage, sale, preparation, cooking, and serving of food. Food waste generation is the sum of food waste diversion and food waste disposal (Food waste reduction alliance, 2012; Leal Filho and Kovaleva, 2015).

Food waste appears at all stages, from food production to consumption (Kuo and Shih, 2016). Food waste is a global problem but where and how it happens is often a local issue that requires a local solution” (Grosse, 2016). As the drivers that generate food waste and the solutions to it are different from those of food losses, food waste is recognized as a distinct part of food loss (FAO, 2017). Edible food waste represents a significant portion of the total food waste (Marthinsen, Sundt, Kaysen and Kirkevaag, 2012) could have been eaten, but was not (Cox and Downing, 2007; WRAP, 2013). Inedible food waste consists of parts of food which cannot be consumed (for example peels, bones, eggshells), possibly edible food consists of food parts which some people eat and others do not (for example, potato skins, cartilage, and chicken feet). The other

food waste category is originally inedible waste (OIE) such as vegetable peelings, bones, and coffee grounds (Silvennoinen, Heikkilä, Katajajuuri, and Reinikainen, 2015). Food waste involves of scratch generated during food processing as well as post-consumer plate waste and unserved food (Trabold and Babbitt 2018).

### **The impact of food waste**

When food is not utilized for feeding persons, it is decided, that the resources are used in efficiently, resulting in negative consequences at the societal, environmental, and economic level; in this sense, food waste is “one of the sustainability matters that desires to be addressed” (Aschemann-Witzel, Hooge and Normann, 2015). Food waste is the number one waste management problem for hotels around the world (Epler, 2017). Social impact, food waste influence food security as the waste of food leads to less food available to everyone (Resource Conservation, 2015). Socially hunger is a large matter both in the United States and all around the world; food that is being wasted could go toward feeding someone who is suffering from malnutrition and hunger the United States Environmental Protection Agency (2016).

Regarding economic benefits, it is found that for every \$1 hotel invested in programs to reduce kitchen food waste; on average they saved \$7 in operating costs. The new study explains that 7:1 return on investment results from buying less food and by minimizing buy costs, rising profits from new menu items developed from leftovers or food previously considered “scraps,” and lower waste management costs. Within just one year, the hotels had reduced food waste from their kitchens by 21 percent on average, and over70 percent had recovered their investment. Within two years, 95 percent had recovered their investment (BioCycle, 2018). The environmental impact is equally significant. 10% of the greenhouse gas emissions from First World countries are released to grow food that will never be utilized (Stuart Tristram, 2014). Research on UK cities showed that some 920.000 tons of food is wasted by the hotel and foodservice sector in the UK, worth approximately \$4.1 billion USD each year. While 46% of wasted food is recycled in the UK nonetheless some 75% of the food wasted could have been eaten. Preventing this amount of food waste could reduce the hotel sector's greenhouse gas emissions considerably, avoiding 2.7 million tons of greenhouse gas emissions (Wood, 2017).

### **Best activities for kitchen food waste reduction**

Staff members are central in every successful and sustainable foodservice operation because they are the ones “who make things happen”. Motivating staff is effective since they can see and appreciate changes or progress as they occur. Acknowledging and providing incentives to staff members who show greater commitment or discover new and effective strategies of reducing waste can help significantly induce positive change on inactive staff members. Staff should be informed of every financial saving or improvement to motivate them further, which means even further savings (Peregrin, 2011). Waste occurs in both the “back of house” (kitchen waste) and “front of house” (consumer waste). Back of house waste is produced from trimmings in the preparation of food and is anticipated to be 4-10% of total food purchased by restaurants (Gunders, 2012). A kitchen is a place where hobby chefs learn to cook and gave tips and basic strategies on how to reduce food waste is very important in the kitchen. Teaching

cooking tips advice should be given to help cooks cut down on expenses. The “root to tip” and “nose to tail” phenomena, the first referring to using every part of the vegetable and the second is referring to using every part of the animal (Egyptian chefs association, 2014). More food is wasted during preparation in the kitchen, than that from customers which believed that preparation and storage food waste was greater than leftovers from customers in a fast food restaurant (Betz, Buchli, Göbel, and Müller, 2015).

Inefficient production procedures also create a great amount of food waste in restaurants. Chefs often refer batch cooking to a method to food waste reduction; however, it depends on the time of the day as well as the size of the batch. For example, the schedule for the breakfast buffet is from 7 am to 10 am and the hotel wants to offer food until 10 am. Yet, the demand is low as it is near closing time. If the hotel still keeps the habit of batch cooking despite the fact that closing time is drawing near, it can create a huge number of leftovers. To prevent creating an unwanted amount of waste, they could offer a cook-to-order model or present their food in smaller containers and change the display. Unskilled trimming, vegetables, fresh fruits, and meat need to go through the trimming and preparing phase to be ready for use. Staff members should acquire appropriate kitchen skills training and anticipate skills to produce food without creating so much waste (Baldwin and Shakman, 2012). A weekly meeting is held by the kitchen manager with cooks to evaluate their progress and identify discrepancies in over-portioning, which they correct in the following week’s service. This practice helps educate staff and foster a zero-food-waste culture (Rethink food waste, 2018).

The inelegant food waste evaluating system provided the hotel with the opportunity to recognize and then investigate the quantities and sources of the food waste. Building on good practice and staff training and making use of the system resulted in an increase in awareness for kitchen staff of the amount of food being thrown away. This improved awareness level is supported by a bigger management focus, which led to a steady decrease in food waste over the trial of over 30% per cover. During the smart food waste monitoring system trial, the Hotel also saw improved food waste segregation and increased rates of recycling (WARP,2012). By lowering food waste using Winnow the Welcome Trust kitchen is saving an estimated 19 tones of CO2 emissions every year. The Winnow System allowed to record waste in a fraction of the time, with an assurance that all sources of waste were captured daily. As a result, the team could focus its efforts on the production and service of a high-quality dining experience. The heightened employee awareness of food waste meant that everyone got involved in identifying opportunities for waste reduction and delivered quick results (Winnow Case Study, 2017). Egyptian chef association (2017) added the other best practices implemented by the participating hotels in the sustainable kitchen project: 1) use vegetables and fruits trim off to make pickles and dried food item, 2)use more local turkey and duck in food offerings rather than beef and lamb,3)transfer knowledge on sustainable food practice to the staff so they communicate these to guests, 4)introduce control sheets to measure yields and waste foods,5)introduce a system for portion control management, 6)communicate with team members regarding food sustainable culture in the operation.

## Hypotheses

This study is based on four hypotheses:

- H1:** Hotels in Alexandria Governorate, Egypt are not paying attention to food waste reduction.
- H2:** There is a statistically significant difference between the food waste actions and kitchen staff awareness among Alexandria hotels
- H3:** The higher the hotel rating acquired; the more awareness of kitchen staff is absorbed about the food waste issue.
- H4:** The higher rating of the hotel, the greater actions are to be done regarding food waste reduction.

## Research methods

### Characteristics of the population

This study is quantitative in nature and in order to achieve the objectives of this study, the questionnaire was used to evaluate food waste reduction actions among hotels' kitchens (ranging from 1 to 5-star hotels), in Alexandria governorate- Egypt. They totaled 44 hotels as follows; (eight are five-star hotels; fourteen are four-star hotels; one is three-star hotels; seventeen are two-star hotels; four hotels are a one-star hotel) and there is Partner Royal Hotel Alexandria is under classification (Egyptian Hotel Guide, 2011). All hotels were involved as the sample in this study. Alexandria is chosen to be a population community for this study because of its attractive sites, most of these sites are located on or near the Corniche, the city's broad waterfront boulevard, and if guests are visiting the city for the first time, this is considered a great base. This makes the city one of the most important tourist destinations in Egypt.

### Research instrument

The data are gathered between October 2017 and April 2018. The questionnaire consists of close questions. It is divided into two sections; the first section consisted of four questions and aims to get information about respondents' characteristics as gender, employment status among kitchen staff, and hotel classification. The fourth question aims to identify the biggest barrier to decrease the discarded food by hotels. The second section is divided into two parts. The first part aims to assess the level of awareness regarding food waste issues among kitchen staff and the second aims to identify hotels' actions to minimize food waste. Each section consists of eight statements using a Likert scale type where "1" indicates strongly disagree; and 5 indicates strongly agree. The questionnaire targets chefs in Alexandria hotels and distributed by hand and mail to maximize the response rate percentage. This approach was adopted by Kasavan , Mohamed and Abdul Halim (2017) to evaluate current hoteliers' practices and participation in sustainable food waste management.

### Sampling and questionnaire distribution

The population size of the study is 1370 kitchens staff in Alexandria Hotels, a total of 300 questionnaire responses were targeted. The valid forms were 253, and the response rate reached (84.3) %. Steven K. Thomson equation was used to calculate the sample size, from the next formula;

$$n = \frac{N \times P (1 - P)}{[(N-1) \times (d^2 \div Z^2)] + P (1-P)}$$

Where:

n =sample size                      N=the population size.              Z= confidence level at 95% (1.96)

d= error proportion =0.05                      P: probability = 50%

This sample is considered a reasonable sample, reliable generalization attempts (Gay & Diehl, 1992). The sample of the study is described as a convenience sample because of, the ease of choosing the study sample, low cost, time and effort, and quick access to the members of the study and gets the results. The convenience sample is a type of non-probability or non- random sampling where members of the target population that meet certain practical criteria, such as easy accessibility, Geographical immediacy, accessibility at any time, or the willingness to participate are included for the purpose of the study. Ecological data are often taken using convenience sampling (Dörnyei, 2007), therefore, the main objective of the convenience sample is to collect information from participants who are easily accessible to the researcher (Lawrence, Green, Wisdom and Hoagwood, 2013).

### Validity and reliability of the study

To ensure the validity of the form, the questionnaire was reviewed by academic professors in the hotel department in tourism and hotel institutions and managers of hotels (10 members). This made out of the core sample to get comments and suggestions about the accuracy of questionnaire questions. Cronbach's alpha was calculated to ensure the reliability of the scale. It was calculated for variables of "knowledge of staff about food waste issue" ( $\alpha_T = 0.930$ ) and " hotel actions towards food waste reduction" ( $\alpha_T = 0.962$ ). Table (1) shows Cronbach's Alpha equal ( $\alpha_T = 0.972$ ). This correlation coefficient statistically is significant at (0.01), which indicated the stability of the forms and usability of the application as the study referred to internal reliability assumed for correlation coefficients greater than (0.7) ( Marković and Rakočević ,2014).

**Table 1**

Reliability statistics for kitchen staff awareness regarding food waste and the hotels' actions

Variable	No of items	Cronbach's Alpha
A. Awareness of the kitchen staff about food waste.	8	0.930
B. Hotels' actions towards food waste reduction.	8	0.962
Overall	16	0.972

Spearman's rank correlation coefficient ( $r_s$ ) was also used to determine inter consistency of the scale items. Correlation coefficient scale items for the overall items ranges from ( $r_s = 0.789$ ) to ( $r_s = 0.884^*$ ). Table (2) means that scale items were statistically significant at  $p \leq 0.05$ .

**Table 2**

Internal Consistency Reliability for kitchen staff awareness regarding food waste and the hotels' actions (n = 253)

VARIABLES	Percent score overall	
	r <sub>s</sub>	p
<b>A. Awareness of the kitchen staff about food waste</b>		
1. The issue of food waste is a critical matter for our hotel.	0.789*	<0.001*
2. I am aware of the environmental impact of food waste.	0.923*	<0.001*
3. I attend at least one conference related to food waste reduction yearly.	0.835*	<0.001*
4. I am aware of the applied waste management program in the hotel.	0.592*	<0.001*
5. I am aware of activities I can perform that prevent pre & post-service food waste generation.	0.877*	<0.001*
6. I know food weight before and after cooking from declared tables in the kitchen.	0.870*	<0.001*
7. I know that some of the kitchen staff is waiting after serving plates to capture and weight the returned food.	0.916*	<0.001*
8. I know that food waste quantity in the last year was the largest in volume than generated in this year.	0.805*	<0.001*
<b>B. Hotels' actions regarding food waste reduction</b>		
1. The hotel reduces using food ingredients that are easily damaged for preparing food.	0.894*	<0.001*
2. The hotel has a waste management team.	0.916*	<0.001*
3. The hotel introduces incentives for reducing avoidable food waste.	0.897*	<0.001*
4. The hotel uses leftovers quality food for the preparation of other meals.	0.848*	<0.001*
5. The hotel provides a knife skills training course to kitchen staff to reduce excessive food waste.	0.918*	<0.001*
6. The hotel prepares a variety of sizes of portion meals to avoid food waste.	0.879*	<0.001*
7. The data of food waste are checked regularly and identify any significant change in waste production and why it has occurred.	0.889*	<0.001*
8. The hotel uses the smart food waste measurement system.	0.884*	<0.001*

r<sub>s</sub>: Spearman coefficient

\*: Statistically significant at p ≤ 0.05

### Data analysis

Obtained data were analyzed utilizing SPSS (Statistical Package for Social Science) version 20.0 for windows. Reliability Statistics was assessed using Cronbach's Alpha test. Data were described in numbers and percentages. The mean and standard deviation was calculated. Pearson coefficient was used to correlate between two normally distributed quantitative variables. Spearman coefficient, to correlate between two distributed abnormally quantitative variables and Significance of the obtained results was judged at the 5% level.

## Results and discussion

### Demographic information of respondents

The male respondents were 70.8% (179) and 29.2% (74) were females. This result was different from the study was done in Kumasi, which showed that most of the food handlers were females (Ababio and Adi, 2012). This is because of the Ghanaian culture, where women are the common food preparers in the hotels in Ghana. Full-time respondents were 97.2% (246) and 2.8% (7) were part-time employees and none of the respondents were retired or trainee as shown in table (3). The 48.2% (122) respondents worked in five-star hotels and 32.0% (81) worked in three -star hotels, 43.95% (111) of respondents answered that "staff isn't sufficient to implement waste management program" and it is considered as the biggest barrier decreasing the amount of food waste in the hotel and "food waste reduction is too expensive" represented 22.5% (57) of respondents. On the other hand, 26.1% (66) of respondents did not know the biggest barrier to decrease the amount of food waste and none of the respondents answered for trash services are currently expensive or specified other answers. Results obtained from a table (3), indicated that food prepared in Alexandria hotels is by males with a full-time job. Although the majority of them worked in five- star hotels, there is a reasonable percentage that should be not neglected, which doesn't know the biggest barriers to decrease the amount of food.

**Table (3)**

Distribution of the respondents' studied according to demographic data (n = 253)

Variable	No.	%
<b>A-Gender</b>		
1-Male	179	70.8
2-Female	74	29.2
<b>B-Employment status</b>		
1-Part time	7	2.8
2-Full time	246	97.2
3- Retired	0	0
4- Trainee	0	0
<b>C-Hotel classification</b>		
1-One star	8	3.2
2-Two stars	10	4.0
3-Three star	81	32.0
4-Four star	32	12.6
5-Five star	122	48.2
<b>D- What are the barriers that prevent food waste reduction in your organization?</b>		
1-Don't know.	66	26.1
2-Staff isn't sufficient to implement food waste management program.	111	43.9
3-Food waste reduction is too expensive.	57	22.5
4-Our hotel focuses on customers' satisfaction priorities.	9	3.6
5-Our food waste is too limited to worry about.	10	4.0
6-Trash services are currently expensive.	0	0.0
7-Other (please specify)	0	0.0

As shown in table (4), 36% of the respondents were with poor awareness of the issue of food waste (<33.33% Poor) and 54.5% of respondents pointed to poor actions among hotels toward food waste reduction (Poor<33.33%). Regarding the awareness of kitchen staff and the issue of food waste, the result of a table (4) pointed out how raising employees' awareness was not tangible among Alexandria hotels, and this result supported hypothesis one that hotels in Alexandria Governorate, Egypt are not paying attention to food waste reduction, which contradicts the study done by Santos (2017) which sees an opportunity of optimizing resources at the restaurant and minimizing food loss is by setting in motion a stricter control and information system based on the yield and loss of ingredients during production.

**Table (4)**

Distribution of the studied sample according to the level of kitchen staff awareness and the hotels' actions to minimize food waste (n = 253)

Variable	Number	Percentage
<b>A. Awareness of the kitchen staff about food waste</b>	-	-
(<33.33%) Poor	91	36.0
(33.3%–66.6%) Fair	84	33.2
(≥66.7%) Good	78	30.8
<b>B. Hotels' actions regarding food waste reduction</b>	-	-
(<33.33%) Poor	138	54.5
(33.3%–66.6%) Fair	80	31.6
(≥66.7%) Good	35	13.8
<b>Overall evaluation for two variables</b>	-	-
(<33.33%) Poor	99	39.1
(33.3%–66.6%) Fair	74	29.2
(≥66.7%) Good	80	31.6

Table (5) shows the mean scores and standard deviation of staff awareness about food waste and hotels' actions. While factors A2 "I am aware of the environmental impact of food waste" occupied the first rank ( $M=3.50 \pm SD= 1.14$ ) followed by A1 "The issue of food waste is a critical matter for our hotel ( $M= 3.31 \pm SD =0.98$ ) and A5 " I am aware of activities I can perform that prevent pre & post-service food waste generation" with ( $M=3.06 \pm SD =1.13$ ) were the highest means scores, factor A8" I know that food waste quantity in the last year was the largest in volume than generated in this year" was in the sixth rank ( $M =2.98 \pm SD=1.43$ ), followed by factor A6" I know food weight before and after cooking from declared tables in the kitchen"(  $M=2.63 \pm SD=1.21$ ), then factor A7 "I know that some of the kitchen staff are waiting after serving plates to capture and weight the returned food"( $M =2.63 \pm SD =1.21$ ) were the lowest means scores factors as shown in table (5). This result indicated the omission of raising awareness among kitchen staff towards the issue of food waste in such areas as food weight before and after cooking and food waste quantity. This result was contrary to the study done by Statbank.dk.com (2016) which referred to that attitudes, knowledge, and awareness of staff members, prior training is equally important to effectively handle food from storage to preparation and the waste generated afterward.

Regarding the hotels' actions towards food waste reduction, the factors got the highest positions were B1 "The hotel reduces using food ingredients that are easily damaged for preparing food waste reduction" (M =4.0± SD=1.11), followed by B3 "The hotel introduces incentives for reducing avoidable food waste" (M=2.62± SD=1.20), then, B7 "The data of food waste are checked regularly and identify any noteworthy modify in waste generation volume and why it has appeared" (M=2.59± SD=1.17) therefore, management should introduce incentives for those staff members who produce the least waste (Legrand, Sloan, and Chen 2013). On the other hand, factors got the lowest positions were B5 "The hotel provides by a knife skills training course to kitchen staff to reduce excessive food waste (M=2.04± SD=1.23), followed by B6 "Hotel prepares a variety of sizes of portion meals to avoid food waste"(M=2.03± SD=1.28)and factor B8 "The hotel uses the smart food waste measurement system" (M=1.97±1.20) was the lowest mean score in hotels' actions. Although better environmental performance will inevitably lead to cost reduction, environmental considerations do not always sit high on the agenda of hospitality managers who are more concerned about short-term profit generation (Pereira-Moliner, ClaverCortes, Molina-Azorin, and Tari, 2012).

In more clarification, hotels' actions like providing a knife skills training course to the kitchen staff; offering a variety of sizes of portion meals to avoid food waste; using the smart food waste measurement system were slightly done by hotels. Although it was mentioned in the study done by Drewitt(2013) that portion size is a key issue and the one-size approach taken by different restaurants is a major cause of food waste, the factor B6 "The hotel prepares a variety of sizes of portion meals to avoid food waste " was ranked at seventh of hotels' actions. Although Smartphone apps as "Wise Up on Waste" have been developed to assist chefs to measure, monitor, and manage food waste in commercial kitchens and the trials showed that the adopters of such technological innovations can minimize food wastage significantly (Gould, 2016), the factor B8" the hotel using the smart food waste measurement system" comes in the last rank of hotels' actions.

**Table (5)**

Means and standard deviations of the kitchen staff awareness and hotels' actions (n = 253)

Variable	Mean	± SD.	Rank
A- Awareness of the kitchen staff about food waste			
1. The issue of food waste is a critical matter for our hotel.	3.31	0.98	2
2. I am aware of the environmental impact of food waste.	3.50	1.14	1
3. I attend at least one conference related to food waste reduction yearly.	3.00	1.13	4
4. I am aware of the applied waste management program in the hotel.	2.99	1.27	5
5. I am aware of activities I can perform that prevent pre & post-service food waste generation.	3.06	1.13	3
6. I know food weight before and after cooking from declared tables in the kitchen.	2.97	1.10	7
7. I know that some of the kitchen staff is waiting after	2.63	1.21	8
			<b>Continued,</b>

serving plates to capture and weight the returned food.			
8. I know that food waste quantity in the last year was the largest in volume than generated in this year.	2.98	1.43	6
Total Score	22.75	2.66	
B- Hotels' actions regarding food waste reduction			
1. The hotel reduces using food ingredients that are easily damaged for preparing food.	4.0	1.11	1
2. The hotel has a waste management team.	2.46	1.24	4
3. The hotel introduces incentives for reducing avoidable food waste.	2.62	1.20	2
4. The hotel uses leftovers quality food for the preparation of other meals.	2.37	.92	5
5. The hotel provides a knife skills training course to kitchen staff to reduce excessive food waste.	2.04	1.23	6
6. The hotel prepares a variety of sizes of portion meals to avoid food waste.	2.03	1.28	7
7. The data of food waste are checked regularly and identify any significant change in waste production and why it has occurred.	2.59	1.17	3
8. The hotel uses the smart food waste measurement system.	1.97	1.20	8
Total Score	20.66	3.09	

### The Correlation between the levels of awareness of the kitchen staff and hotels' actions

It was shown at a table (6) that there is a significant correlation between the levels of awareness among the kitchen staff regarding the issue of food waste and hotels' actions. The correlation is statistically significant at  $p \leq 0.05$  ( $r_s 0.943^* p < 0.001$ ). According to correlation using the guide that **Evans (1996)** suggested that, the absolute value of  $r$ : .00-.19 “very weak”, .20-.39 “weak”, .40-.59 “moderate”, .60-.79 “strong” and .80-1.0 “very strong”. The significant Pearson correlation coefficient ( $P$ -value  $< 0.001^*$ ) confirms that there appears to be a very strong positive correlation between the two variables.

#### Table (6)

Correlation between the of kitchen staff awareness about food waste and hotels' actions (n = 253)

Variable	A. Awareness of the kitchen staff about food waste	
	$r_s$	$p$
B. Hotel actions towards food waste reduction	0.943*	$< 0.001^*$

\*: Statistically significant at  $p \leq 0.05$

Table (7) shows the correlation in detail between levels of awareness among kitchen staff about the issue of food waste and hotels' actions towards food waste reduction. Results appeared that hotels' actions towards food waste reduction items were positively correlated with all items of awareness of the kitchen staff about food waste ( $p \leq 0.001$ ), thus, introducing evidence for accepting H2: there is a statistically significant difference between the food waste actions and kitchen staff awareness among Alexandria hotels. This result matches the study done by Bohdanowicz, Zientara, and Novotna (2011) that referred to food waste reduction which can make a positive impact on staff. Employees have a better knowledge of the quantity and the character of hospitality food waste and can, therefore, identify the key operational areas for intervention.

Heikkil, Reinikainen, Katajajuuri, Silvennoinen, and Hartikainen (2016) concluded that with better communication with the employees, kitchen waste could be reduced. In general food waste is the result of poor training knowledge or management inattentiveness. Unfortunately, managers and employees feel that a small amount of food waste is unimportant (Dopson & Hayes, 2011).

**Table 7**

Correlation results about the sub-variables of hotels' actions and the kitchen staff awareness about food waste (n = 253)

A) Awareness of the kitchen staff about food waste		B ) Hotels actions factors							
		B1 reducing using food ingredients that are easily damaged	B2 a waste manage ment team	B3 introduces incentives for reducing avoidable food waste	B4 Using leftover s quality food	B5 Provide knife skills training course	B6 variety of sizes of portion meals	B7 data of food waste are checked regularly	B8 the smart food waste measurem ent system
A1- The issue of food waste is a critical matter for our hotel.	<b>r<sub>s</sub></b>	0.640*	0.793*	0.680*	0.559*	0.745*	0.770*	0.791*	0.721*
	<b>p</b>	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
A2-I am aware of the environmental impact of food waste.	<b>r<sub>s</sub></b>	0.689*	0.707*	0.706*	0.629*	0.762*	0.625*	0.696*	0.572*
	<b>p</b>	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
A3-I attend at least one conference related to food waste reduction yearly.	<b>r<sub>s</sub></b>	0.707*	0.864*	0.804*	0.509*	0.772*	0.735*	0.760*	0.681*
	<b>p</b>	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
A4-I am aware of the applied waste management program in the hotel.	<b>r<sub>s</sub></b>	0.693*	0.870*	0.819*	0.473*	0.758*	0.775*	0.753*	0.723*
	<b>p</b>	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
A5-I am aware of activities I can perform that prevent pre & post-service food waste generation.	<b>r<sub>s</sub></b>	0.697*	0.705*	0.629*	0.474*	0.748*	0.723*	0.791*	0.670*
	<b>p</b>	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
A6-I know food weight before and after cooking from declared tables in the kitchen.	<b>r<sub>s</sub></b>	0.643*	0.667*	0.602*	0.420*	0.701*	0.695*	0.753*	0.661*
	<b>p</b>	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
A7-I know that some of the kitchen staff is waiting after serving plates to capture and weight the returned food.	<b>r<sub>s</sub></b>	0.700*	0.855*	0.807*	0.535*	0.805*	0.710*	0.787*	0.703*
	<b>p</b>	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
A8-I know that food waste quantity in the last year was the largest in volume than generated in this year.	<b>r<sub>s</sub></b>	0.733*	0.696*	0.555*	0.532*	0.725*	0.720*	0.783*	0.602*
	<b>p</b>	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

r<sub>s</sub>: Spearman coefficient

\*: Statistically significant at p ≤ 0.05

It's obvious in a table (8) that there is a significant correlation between hotel rank and the level of awareness of the kitchen staff about food waste ( $r_s$  0.255\* &  $P < 0.001^*$ ) and this is an evidence to accept H3: The higher the hotel rating acquired, the more awareness of kitchen staff is absorbed about the food waste issue. Moreover, there is a correlation between hotel's actions towards food waste reduction and the rank of the hotel and this correlation was significant ( $0.301^* < 0.001^*$ ) and this result supported hypothesis four that the higher rating of the hotel, the greater actions are to be done regarding food waste reduction, which is an indicator for increasing managers' awareness in high-rank hotels for applying food waste reduction activities and raising awareness with the danger of increasing food waste but, on the other hand, this interest dropping in hotels with low-rank. This result matches the study was done by Webster (2000) that many small hotel firms take very little action to minimize their environmental impacts and the other study conducted by Alvarez, Burgos Jimenez, and Cespedes Lorente (2001) which declared that the appropriation of green practices by a hotel depends on factors such as the hotel size, organization age, hotel type, brand size, hotel association or other hotel characteristics. Additionally, Marthinsen *et al.* (2012) argued that the hotel category plays an important role in its waste generation; as it is supposed that there is a first-class outlet that can control food waste by serving smaller portions of high-quality food.

**Table 8**

Correlation between the hotel classification, the level of awareness of kitchen staff and the hotel's actions to minimize food waste (n = 253)

Variables	Hotel Classification	
	$r_s$	p
<b>A. Awareness of the kitchen staff about food waste</b>		
1. The issue of food waste is a critical matter for our hotel.	0.309*	<0.001*
2. I am aware of the environmental impact of food waste.	0.151*	0.016*
3. I attend at least one conference related to food waste reduction yearly.	0.139*	0.027*
4. I am aware of the applied waste management program in the hotel.	0.744*	<0.001*
5. I am aware of activities I can perform that prevent pre & post-service food waste generation.	0.386*	<0.001*
6. I know food weight before and after cooking from declared tables in the kitchen.	-0.046	0.470
7. I know that some of the kitchen staff is waiting after serving plates to capture and weight the returned food.	0.134*	0.033*
8. I know that food waste quantity in the last year was the largest in volume than generated in this year.	-0.248*	<0.001*
<b>Overall staff awareness items</b>	<b>0.255*</b>	<b>&lt;0.001*</b>
<b>B. Hotel's actions towards food waste reduction</b>		
1. The hotel reduces using food ingredients that are easily damaged for preparing food.	0.162*	0.010*
2. The hotel has a waste management team.	0.406*	<0.001*
3. The hotel introduces incentives for reducing avoidable food waste.	0.200*	0.001*

Continued

4. The hotel uses leftovers quality food for the preparation of other meals.	0.127*	0.043*
5. The hotel provides a knife skills training course to kitchen staff to reduce excessive food waste.	0.243*	<0.001*
6. The hotel prepares a variety of sizes of portion meals to avoid food waste.	0.172*	0.006*
7. The data of food waste are checked regularly and identify any significant change in waste production and why it has occurred.	0.220*	<0.001*
8. The hotel uses the smart food waste measurement system.	0.381*	<0.001*
<b>Overall Hotels' actions</b>	<b>0.301*</b>	<b>&lt;0.001*</b>
<b>Overall</b>	<b>0.813*</b>	<b>&lt;0.001*</b>

### Limitation of the study

In this study, it was difficult to get data about the quantity of food waste in the lower-ranked of hotels. The study also neglected to deeply measure the effect of skills among kitchen staff on the generated kitchen food waste. Additionally, the turnover rate effect on food waste reduction has been neglected. Moreover, the study included a small number of unskilled kitchen staff so; it was difficult to make a comparison between the generated food wastes between skilled and unskilled kitchen employees. Also, the study didn't involve the barriers to food donation.

### Conclusion

Food waste is gaining public attention, providing hotels with the opportunity to leakage waste-reduction efforts to enhance their reputation with guests, employees, and investors (National Restaurant Association, 2016). The issue of the food waste generation in the pre-consumer phases has attracted less attention especially, in the hospitality sector. (Papargyropoulou *et al.*, 2016; Pirani and Arafat, 2014; 2016). This paper showed the impacts of food waste and heightened the importance of implementing food waste practices in hotels, moreover; the study reviewed the best activities in a kitchen for decreasing the volume generated of food waste. It is evident that the field study shows the decreasing level of awareness among kitchen staff in Alexandria hotels regarding the issue of food waste. Most of the employees did not attend at least one conference annually related to food waste reduction; the majority of kitchen staff did not know the volume of food waste generated annually and they did not give attention to know if this quantity decrees or not; in addition, kitchen staff did not give attention to identify the weight of food before and after cooking.

On the other hand, the research intended to shed light on the lack of applying some actions to reduce food waste in the kitchen among hotels, for example, a small number of hotels pays attention to provide rewards for employees who generate a little food waste volume; to form food waste management team; to reuse the food waste to produce new food items; provide cutting skills training for employees to minimize food waste; offer various portion sizes for meals and finally using new technology in a kitchen to control food waste. In essence, the study found how implemented actions towards food waste reduction were with direct relation to a level of kitchen staff awareness. Besides, managers of high-rank hotels have a great attention for carrying out food waste

management programs and strive to raise employees' awareness but, unfortunately, this interest was decreased from the side of managers of low-rank hotels.

### **Recommendation and Further study**

Food waste reduction should be a priority for hotels in Egypt. Hoteliers should develop a sustainable kitchen training program. Furthermore, develop strategies used in food waste management that involve a system for documenting food waste data and discover new practices to reduce food waste. Moreover, insert a food ration control system and provide intelligent technology to help reduce food waste should be considered as possible actions done by hoteliers.

It is necessary to set the professional standard recipe involved the expected amount yield to prepare an item and apply the control system to measure the amount of food wasted and the amount of food produced. Thus, it is suggested to adjust menus to start herb and vegetable gardens on hotel premises, in addition, to start a campaign as "no garbage, clean up", moreover, offer more local and authentic Egyptian foods and finally and finally, there is also a real need to establish a protocol between the food bank and Egyptian hotel association, under this, hotels donate food waste. Future academic research should involve more in studies about managerial approaches to food waste reduction and standardized methodology used in appraising the content of hospitality food waste. There is thus an urgent need for a study on the effect of the relationship between employees' involvement in food waste programs and their satisfaction towards their job. Lastly, the future study could focus more on customers' behaviors to increase sustainable effort and the effect of kitchen design on food waste generation.

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### إدارة المخلفات الغذائية: دراسة استكشافية للطهاة المصريين

شيماء أبو السعود محمد سليمان

المعهد العالي للسياحة والفنادق والحاسب الآلي، السيوف، الإسكندرية.

#### المفص

#### معلومات المقالة

#### الكلمات المفتاحية

لقد أصبح توليد كميات كبيرة من مخلفات الطعام في الأونة الأخيرة من أكثر المشكلات التي تواجه قطاع الضيافة. حيث تعتبر المطابخ أكبر مصدر تدفق للمخلفات في الفنادق وحوالي أربعة إلى عشرة بالمائه من الطعام الذي يتم شراؤه في المطاعم يصبح فاقد في المطابخ، سواء كان صالحا للأكل أم غير صالح، ومع ذلك فإن موضوع إدارة مخلفات الطعام في قطاع الضيافة لم يحظى بالإهتمام الكافي. وقد استعراض البحث الدراسات والأبحاث المتعلقة بإدارة مخلفات الطعام في المطابخ من وجهة نظر الطهاة بفنادق محافظة الإسكندرية بمصر. الهدف الرئيسي من هذه الدراسة هو تقييم الممارسات المتبعة في المطابخ وزيادة وعى العاملين بكيفية الحد من إهدار الأغذية، فضلا عن أن البحث يناقش تطبيق نظم إدارة مخلفات الطعام الذكية في المطابخ. ولتحقيق هذه الأهداف فقد تم توزيع (300) استمارة استبيان إلى موظفي المطابخ في جميع الفنادق، وكان عدد الاستمارات الصالحة (253) استمارة بنسبة 84.3%. وتم وصف البيانات باستخدام المتوسط والانحراف المعياري وارتباط معامل بيرسون وسبيرمان. وقد أظهرت النتائج انخفاضا في وعى العاملين بالمطابخ بأهمية تقليل حجم المخلفات الغذائية الذي كان ناتجا عن ضعف في تطبيق الإجراءات التي من شأنها الحد من الإهدار في المخلفات الغذائية وقد أوصت الدراسة ببعض الممارسات الفعالة في تخفيض حجم المخلفات الغذائية في المطابخ.

إدارة مخلفات الطعام؛  
المخلفات العضوية؛  
الاستدامة؛ مخلفات  
الطعام الصالحة للأكل.

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