STUDY OF FOOD SECURITY THROUGH FOOD WASTE AND LOSS CONTROL MECHANISM IN KENYA

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Abstract

Food waste within the hospitality's restaurant operations contribute immensely to the global food wastes, and studies reveals thatit contributes 45% of wastes through food preparation and production processes, 21% through food spoilage as a result of poor storage and 34% through food leavers as observed from customer plates. Further, research confirms that food wastage has directly resulted in starvation of over 842 million people, with over 1.3 billion tons documented as food wastages, while substantial amounts of this food waste and losses taking place within the larger hospitality restaurant's operations.

The factors influencingthese food waste generation included; the type of service, the type of food served, the expected and actual numbers of customers, the season and the food service organization, which are addressed by this study in an attempt to propose ways of reducing food waste and losses, and hence promoting food security.

The study narrows down to the prevention solutions approach, which was employed on the basis of; menu design, portion choices and customized dishes, use of smaller plates during service, procuring optimized quantities, proper application of produce specifications, and employment of waste tracking and analytics methodologies, which when appropriately applied in the restaurant food operations business will significantly reduce food waste and losses, and by extension global food insecurity.

Key Words: Food Waste, Food Loss, Food Security, Restaurant Operations

INTRODUCTION

Food waste is defined as "any by-product or waste product from the production, processing, distribution, and consumption of food" (Okazaki W. T., 2008). For purposes of this study, food waste is characterized as any food discarded as part of the food purchasing, storage, production and service process in the hospitality sector. This could be food storage waste, preparation waste or waste from serving dishes or the guests' plates. According to research findings by Tuppen (2014), 45% of food waste and losses is registered as a result of food preparation and cooking processes in the kitchen, 21% as a result of food spoilage due to poor food storage and 34% as a result of food wastes by customers as plate debris. A combination of all these hospitality restaurants' food losses has witnessed significant food wastes regionally, nationally and globally.
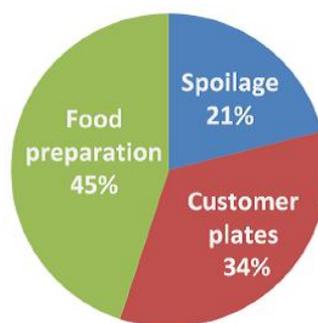

Fig 1: Food Waste and Losses (Tuppen,2014)

Conversely, the issue of global food losses and waste has not received much attention though, with the current focus on food security through promotion of sustainable agriculture and supporting small scale farmers (UNDP). Yet, increased productivity must be accompanied by efforts to minimize the levels of waste and losses for this goal to be achieved. According to FAO (2011), almost one-third of food produced for human consumption, approximately 1.3 billion tons per year is either lost or wasted globally, a significant amount through the hotels' restaurant operations and thus a draw-back on the fight against food insecurity. Nonetheless, food waste in the hospitality industry has recorded an exponential increase in the past few years, and hence up to 10% of food purchased by restaurants does not reach the customer because of waste at

different stages of the food supply chain (Buzby & Hyman, 2012; Gunders, 2012). However, researchers have focused on food waste in homes, but studies on restaurant food waste are lacking, even though the hospitality industry is critically important to the world economy, as it is the largest private sector employer with an estimated 14 million employees (SBA, 2014) as well as income earner.

Moreover, the hospitality sector in many parts of the world is expected to see significant rates of growth in the next few years. This is true not only for the United States of America (Berman, 2014), European countries (Milburn & Hall, 2014), and the countries of the Gulf Cooperation Council (Meet Middle East, 2013) but also for many African countries including Kenya. This expansion in hospitality sector operations would lead to an increase in food waste generated from the restaurant operations. In the sector, the cost of solid waste includes various factors such as the disposal and transport of waste as well as food costs (Schneider, 2015). Better food waste and loss management may therefore lead to food security in addition to significant savings for businesses. Other benefits of ecofriendly waste management include low food costs as a result of food waste and loss controls (Ball& Abou Taleb, 2010).

There are not many scholarly publications available on food waste management in the hospitality sector. Quite a bit of research has been done on food wastes and losses in the line of global food supply but not on a global food demand perspective (Bender, 1994). Post-harvest losses should be considered more carefully, for example, a 2013 review paper which accounted for publications from all over the world on food waste prevention in the food supply chain mentioned only one publication about cafeterias in Brazil, two publications about the hospitality sector in general (one with reference to the UK and the other with reference to the Nordic countries), and one publication about hotel restaurants in Norway (Schneider, 2013). However, more literature is available on this topic in the form of reports published by various entities around the world, describing the food waste generated at hospitality sector establishments in certain countries or regions. Some of these studies describe the composition of the food waste in terms of the types of food it consists of (Parfitt et al., 2013) though many of the reports available do not mention the quantities of avoidable food waste (Marthinsen et al., 2012). A recent review published on waste management in the hospitality industry in general and food waste management in that sector in particularrevealed that substantial change in the way food is produced and consumed in the hospitality sector is necessary if the generation of this waste is to be substantially minimized (Pirani & Arafat, 2014). Besides, effective food waste minimization strategies would mean more lean, cost-effective operations and therefore smaller consumption of food resources.

Researchers should take an interest in food waste for two major reasons (Buzby & Hayman, 2012): because of the increasing global population, food production will need to increase by 70% to 100% to sustain the projected population growth to 9 billion people by 2050; Buzby and Hyman (2012) also noted that food waste also fritter away a large amount of money and other resources used to produce, transport, store, and distribute food products that eventually become worthless.

When considering the current status of food waste management in the United Arab Emirates hospitality sector, it is imperative to discuss the policies which have recently been put into place to minimize food waste and losses (Meet Middle East, 2013). The Abu Dhabi Tourism and Cultural Authority as an example of operations in the Middle East had aimed to reduce the amount of hospitality food waste and losses by 20% by the end of 2010 as a first step in its environmental program (Bundhun, 2010; Green Hotelier, 2010). Likewise, recently Abu Dhabi's Centre of Waste Management implemented an initiative for "cleanliness" which was established to monitor and control all food waste-related activities for the commercial, industrial, and construction sectors (Ramos, 2011). As part of this program, a tariff system that charges per ton of waste generated in these sectors was launched, which applies to the hospitality sector as well. In addition, the top 5% of food waste producers (each of which generates more than 250 tons of waste per year) was asked to provide a standardized audit report. In view of the global food wastes and losses in relation to hospitality restaurants operations as depicted by the global trend of food waste, there is an urgent need for hospitality professionals to take a leading step towards this greatest monster that clings on the shoulders of all the global population compromising the world's food security, including the control strategies as envisaged in the case study of the Middle East.

PROBLEM STATEMENT

Research shows that consumers in developed as well as developing countries waste almost as much food as the entire net food production of sub-Saharan Africa (Berman, 2014; Schneider, 2015) on an annual basis, leading to starvation of over 842 million people in the world (Ramos, 2011). On a global basis therefore, one third of the food produced for human consumption every year, which is approximately 1.3 billion tones, gets lost or wasted. Moreover, when food rots it creates methane (CH_4) which has 21 times the global warming potential of carbon dioxide (The restaurant food waste action guide, 2018). Ultimately, every time food is wasted, the water, energy, time, manpower, land, fertilizer, fuel, packaging and money

put into growing, preparing, storing, transporting, and cooking the food is wasted, and thus reducing food waste helps in stopping wastage of money and a host of other resources.

A substantial amount of these food wastes takes place within the hospitality industry's restaurantsector and thus the reason for stringent measures to be instituted for purposes of curbing these wastes and losses. As the industry goes through a global exponential growth (Milburn et. al., 2014), eating out, and specifically in hospitality's restaurant sector is becoming a frequent habit for the global citizens with over 50% people across the globe having meals in restaurants every day (Brooklyndhurst, 2013). Food wastes and losses comes from a variety of sources within the restaurant operations including; spoiled or out of date food items, food peelings and trimmings,inedible by-products, e.g. bones, coffee grounds, tea leaves, Kitchen error and Plate waste (Tuppen , 2014).

Food waste generated through restaurant operations has been increasing steadily since 1974 (USDA, 2014). In 2011, an estimated 89 billion pounds of food waste occurred in restaurants and other food service facilities in the United States (Buzby et al., 2012). The general business problem is that food waste negatively affects hospitality's restaurant operations resulting not only in food insecurity but also in loss of profitability (SBA, 2015). The specific corporate problem is that some restaurant managers lack strategies and means to reduce food waste to increase food security and thus profitability.

In overall, food wastes from hospitality restaurant's operations accounts for 30% of the total global food wastes (Jarie & Peter, 2012), which translates to 0.4 billion tones every year. This is such a huge amount of food that can feed several nations of the world and thus the need to institute measures towards saving such avoidable food wastes and losses, hence improving food security across the world. This study review therefore aims at analyzing the hospitality's restaurant operations with a specific focus on the possible food waste control measures that can bear fruits towards the global food security.

STUDY OBJECTIVES

This study review was guided by the following objectives;
1. To analyze food waste and loss along the hospitality's restaurant food supply chain.
2. To establish the food waste and loss control measures within the hospitality's restaurant operation.

STUDY APPROACH

As a result of minimal studies on hospitality's restaurant operations food waste and loss control (Sanaa & Arafat, 2015), very little has been proposed in relation to restaurant food waste and loss controlwithin the broad studies on food security. However, for purposes of grasping the underlying association between the restaurant operations towards food waste and loss control in relation to food security, the stakeholder theory (Freeman, 1984) was applied for in this study review.

STAKEHOLDER THEORY

Stakeholder theory dates back to the *Strategic management* (Freeman, 1984): *Astakeholder approach* seminal work of Edward Freeman published in 1984 (Kocatepe, 2017). Freeman (1984) summarizes the premise of stakeholder theory in relation to the decisions that managers make when responding to stakeholders who can affect firms, and argue that business leaders are under obligation to make decisions that reflected only the wishes of shareholders. Researchers have since proposedcontrasting views that leaders of corporations must accommodate a wide spectrum of stakeholders (Freeman, 2010). Support for this view originated from Madsen and Bingham (2014), who suggested that leaders of corporations must establish networks in communities where the organizations operate for social good and for profitability. In relation to the hospitality's restaurant businesses, all organizations have internal and external stakeholders that influence the decision-making process (Madsen & Bingham, 2014; Tang & Tang, 2012), with an inclusion of mainly employees and managers as the internal stakeholders, and customers, suppliers, the community, the government, and others as the external stakeholders (Tang & Tang, 2012).

Dissimilarly, some researchers have referred to stakeholders as groups that support and maintain business organizations such as restaurants (Ackermann & Eden, 2011). Support from these groups is important, as recipient organizations would not survive without it. However, leaders of hospitality firms sometimes fail to capture the opportunities to establish working relationships. Stakeholders' influence in the general business enterprises has increased in the early 21st century as customers, employees, communities, and others have taken the responsibilities of decision-making and other activities in companies. Verbeke and Tung (2013) noted that stakeholders have the capacity to influence the direction of a company by controlling access to resources, and thus the best tool to determine what resources to make available and thereby determine organizational altitude.

Wolf (2014) on the other hand identified two types ofstrategies available to stakeholders who provide resources to a business organization. According to Wolf (2014), first, stakeholders can dictate whether company owners receive resources or not

since the ability to withhold resources is a form of stakeholder influence to the organization. Secondly, stakeholders may decide to continue supplying resource, but with strings attached (Wolf, 2014). Thus the premise of stakeholder theory has gained prominence in the business community since the mid-1990 (Makani, 2016) and hence is applied in this study.

In relation to the stakeholders' theory, Hospitality's restaurant owners need to determine each stakeholder's capacity to threaten or tocooperate with the organization's strategic goals. They must identify stakeholders who are supportive or non-supportive, a mixed blessing, or marginal stakeholders and allocate resources to try to change stakeholders from being nonsupportive to a more desirable position (Savage, Nix, Whitehead, & Blair, 1991). Tang and Tang (2012) contended that stakeholders are capable of influencing organizations in positive or negative ways; with examples of negative stakeholder influence including; damage to company reputation, negative press coverage, boycotts or protests, and shareholder resolutions that can potentially affect company stock price and lead to higher operating costs and legal fees. Consequently, negative campaigns can keep customers away and lead to massive food and resource waste, while positive stakeholders' influence on firms includes value creation, good corporate image, and the achievement of sustainability goals, among others (Darškuvienė & Bendoraitienė, 2015).

Furthermore, Freeman (2010) noted that restaurant owners should find ways to operate in a socially responsible manner and address stakeholder demands, and this precinct gave birth to two notable categories of stakeholders that managers deal with regularly as primary and secondary stakeholders. According to Freeman (2010), Primary stakeholders have a direct or contractual connection with a company and are immediate beneficiaries of the organization, while Secondary stakeholders have no direct economic dealings with the organization, but they have influence and can easily affect the activities of the organization (Garces-Ayerbe et al., 2012; Savage et al., 1991). Thus restaurant managerscannot arbitrarily conclude that certain stakeholders will be supportive or non-supportiveon a given issue since stakeholder interests tend to be dynamic, Instead, theyshould evaluate stakeholder preferences, interests, capabilities, and attitudes to determine which ones to trust with key responsibilities, which ones to educate and to uphold, which ones to use marginally, and which are the non-supportive ones to eliminate. Brower &Mahajan (2013) added that managers who fail to act on non-supportive stakeholders lose money, reduce profits, and risk winding down their businesses prematurely.

THE CONCEPT OF STAKEHOLDER THEORY AND SOCIAL CORPORATE RESPONSIBILITY (SCR)

Social Corporate Responsibility (SCR) concept has prompted company executives to focus on balancing business profits with social and environmental responsibilities (Miller, Hayes, & Dopson, 2002). Some managers in corporations are conserving the environment and practicing social responsibility at the same time because of increasing pressure from internal and external stakeholders. Corporate social responsibility means that company executives should not intentionally or knowingly inflict harm to stakeholders but should instead function responsibly, protecting the communities, and the environment (Chan, 2013).

Additionally, Tang and Tang (2012) noted that business owners should interact with stakeholders on an ongoing basis to promote a better working relationship between owners and all stakeholders. A spirited discussion about corporations taking responsibility for the impact of their actions on the social and ecological environment has been ongoing for several decades, and Kechiche & Soparnot (2012) observe that in business dealings, organizationmanagers are increasingly under pressure to focus their CSR efforts on sustainable developmentbeyond shareholders. Thus restaurant managers must consider factors that can potentially affect operations even as they conduct their business activities. Kechiche & Soparnot (2012) indicate that the managers of numerous socially responsible firms are implementing business practices that meet the expectations of individuals or groups who can affect the firms' actions as defined by Freeman's initial definition of the stakeholder theory.

Accordingly, multiple researchers have contended that a strong CSR record may generate a better relationship between a company and its stakeholders (Fassin, 2012; Lii & Lee, 2012). Moreover, Brower and Mahajan (2013) found that, in turn, stakeholders commit to organizations through loyalty and investments, and Aguinis & Glavas (2012) conclude that stakeholders fetch different expectations, take on different roles, and engage in different activities while trying to convince company executives to practice CSR. Some stakeholders have a tendency to pressure firms to participate in CSR for self-interest reasons, for group dynamics, or for ethical or moral considerations (Cheng, Ioannou, & Serafeim, 2014). Furthermore, Cheng et al. (2014) observed that stakeholders may sometimes be the necessary catalysts for better access to resources such as attracting quality human capital, capturing uncontested blue ocean opportunities and market niches, or contributing socially to the communities where they operate (Kim & Mauborgne, 2014).

COMPARATIVE STUDY RESULTS AND DISCUSSIONS

Brooklyndhurst (2013) presents an estimated annual statistics showingthat UK hotels Produces289,700 tons of waste each year, including 79,000 tons of food waste, which is approximately 9% of the total food waste across the hospitality and food

service sector in the Country. Spreading these statistical effects across all countries of the world gives terrifying figures of food wastes and losses from the hospitality's food service sector, even though the statistics are extremely high in some countries, and at the same time expected to swell as a result of increased hospitality's restaurant business (Oelofse, 2014).

Shockingly, Jarie & Peter (2012) reports that food wastes from the global hospitality restaurant's operations accounts for 30% of the total food wastes which translates to 0.4 billion tones every year. This amounts to between one-third and one-half of all food produced (Analysis of U.S food waste among food manufacturers, retailers and restaurants, 2016). Losses and waste occur at all stages of the restaurant food supply chain or value chain. Nonetheless, most loss in low-income countries occurs during production, while in developed countries much food, about 100 kilograms (220 lb) per person per year, is wasted at the consumption stage (Beckford, Campbell & Barker, 2012). Food waste from hospitality organizations is mainly generated from restaurant operations as a result of the kitchen brigades' application of culinary skillson preparation and production of food products along the food supply chain. According to the results of a study carried out by Tuppen (2014), food waste from hotels comprises of 20% from potato products, 08% from bakery products, 04.5% from farinaceous products, 15% from fruits and vegetables, 05% from fish and meat products, 03% from dairy and egg products, 01% from whole servings and 05% from other food products as illustrated in the graph below.
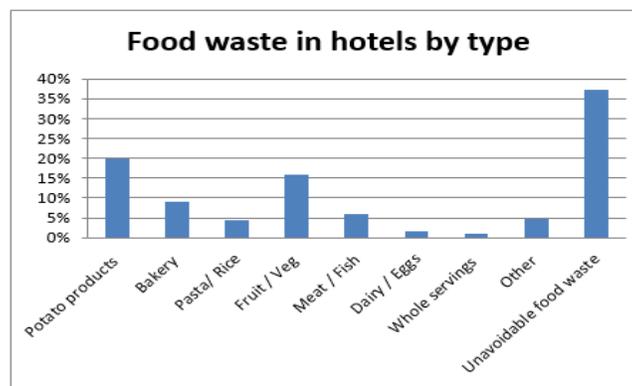

Fig 2: Food Waste and Losses (Source; Tuppen, 2014)

Accordingly, the study review was guided by two objectives, and therefore for purposes of this paper, an in-depth review was carried out on food wastes and losses in restaurants and the eventual food waste and loss control mechanism put in place to curb food insecurity as a result of wastes and losses within the hospitality's restaurant operations.

Factors affecting food waste generation

Researchers have been concerned with the factors that determine food wastage and loss within the hospitality's restaurant operations (Sanaa et. al., 2015), and the factors therefore found to be most relevant when it comes to determining the amount of food waste generated are discussed below.

Type of service: Research has shown that the style of service is one of the factors which greatly contribute to the production of food waste in the hospitality's restaurant sector (Sanaa et. al, 2015). For instance, the a la carte style of service is reported to generate less waste as compared to the buffet style of service (Hackes et al., 1997). From the study results by Sanaa & Arafat (2015), it is clear in general, that a la carte event has performed better in terms of food eaten versus food wasted than the buffet but not as good as the breakfast buffet. This may be attributed to various reasons such as the nature of the food being served (Silvennoinen et. al., 2012), The study also depicts surprising figures of how food waste from plates made up 12% of the total input food in the case of the a la carte event, which for purposes of this study review is platewaste.

However, these results are in opposition to studies by Lam (2010) and Sarjahani et al., (2009) which generally demonstrates that the a la carte style of service helps to reduce plate waste. Nonetheless, such results could potentially be justified in light of the nature of food that was being served or due to large serving portions or due to local culture, as in some cultures, it is considered inappropriate to finish all the food on one's plate, an indication of how an a la carte event may also be wasteful, hence a general strategy to convert all buffet events to a la carte events to reduce food wastage may not be the solution to food waste management in the hospitality sector.

*Type of food served:*From the studies carried out on food waste in restaurants, Sanaa & Arafat (2015) compared two a' la carte events at property B1 and C2, and found out that at property B1, there was 10% less preparation waste than at property C2. An explanation for this variance may be the fact that the a la carte restaurant at property B1 served only Italian food

while that at property C2 served a more international menu reflecting several cuisines. These results therefore could lead to a conclusion that the preparation waste generated depends on the types of dishes prepared. According to Parfitt et al., (2013), there tends to be more preparation waste from fresh and rawingredients and so, vegetable-based dishes may be expected to generate more preparation waste than pasta-based dishes. Similarly, the same study results by Sanaa & Arafat (2015) shows less preparation waste during a breakfast buffet, compared to a lunch buffet, which may again be attributed to the type of food served during the breakfast buffet, as they tend to serve foods such as cereals and jams which have a longer shelf life (Siebers, 2013) and so minimizes food waste generation. Thus in view of these study results, hospitality establishments can identify thosetypes of food/dishes which tend to generate less waste during their preparation and try to preferentially serve those dishes/food or highlight them by integrating them into menus which prospective clients can chose for events.

Consequently, the significant amount of food waste from serving dishes as depicted by the study results (Sanaa et. al,. 2015) may be explained not only based on the style of service, but also based on the type of food served as well as the size of the serving plates. As a result, the guests may only eat some food from the outer edges of the circular dish which was otherwise completely filled with food. In fact, "not all food is created equal, and as suchmuch of the food wastes on plates by customers comprise of carbohydrates (Hirsch & Harmanci, 2013). Thus this all goes to show the impact of food composition and presentation on the post-consumer waste generated.

Expected and the actual number of customers:This factor which greatly contributes to the production of food waste in the hospitality sector as a result of inaccurate forecasting of consumer demand, inherently connected with the guest show-up rate. The lower the value of this ratio, the more the food waste that can be expected to be generated (Gu, 2014). Hospitality establishments try to be as accurate as possible in their predictions of how many guests to expect through reservations, in order to save on food costs. Conversely, under-estimating the amount of food needed to fulfill customer demand is not a risk most hospitality establishments are willing to take and so they prefer to err on the side of providing excess. Parfitt et al., (2013) contents that; *"achieving the right balance, when deciding how much food to cook, is not at all a straightforward procedure"*. Thus it depends on other aspects such as knowledge of past guest patterns, predictability of the guests' numbers, the size of the menu, and external factors such as other hotels/restaurants located in the vicinity of the property. However, with the increase in technology, predicting how much to cook can be done using computerized tools (Miller et. al., 2002), though many chefs prefer to just rely on their own experience. However, Mackenzie et al., (2011) confirms that it is not unusual for circumstances to change suddenly at the last minute rendering cooking quantities rather inaccurate.

From the study contacted by Sanaa & Arafat (2015), It leads to the conclusion that, the hospitality properties which had the least percentage of food consumed were those with the lowest guest show-up rates, as the results of the lunch buffet at property B1 which registered the lowest show-up rate of 18 actual guests viz-a-viz 38 expected guests, only 22% of the food was eaten, and this was also the event with the greatest percentage of waste from serving dishes. In the same way, the event where the greatest percentage of food was eaten (82%) was the breakfast buffet at property B2 which registered the second-highest show-up rate of 191 actual guests viz-a-viz 220 expected guests. However at property A3, the number of guests who attended the food service was more than expected, forcing the kitchen staff to do significant last minute food preparation. As a result, a significant quantity of unconsumed food resulted, which included food that had been put in the serving dishes at a very advanced stage of the buffet service but in the end was in excess. Though some of that food was saved for later use (8%), a larger portion of it was still disposed of (22%), as seen in the study results reported (Sanaa et. al., 2015).

Season:Seasonal variation comprises of yet another factor of importance affecting food waste generation. The foodwaste generation data of the Masdar Institute canteen show that in 2012, waste amounts did not vary significantly by the day of the week, though, since the number of guests catered to on weekends tended to be less than the number on weekdays, the daily waste per guest on weekdays was less than that during the weekend (Sanaa et. al., 2015).Further, the results of the same study reveals that in 2013, the variation between weekends and weekdays was in terms of the lower daily waste amount values during the weekends, with the per guest values varying randomly throughout the week (Sanaa et. al., 2015), thus with regard to monthly variation, which occurred mainly in August of 2012 and July of 2013, the food waste generated was reduced. Similarly, the waste values in the study show howthe waste generated in 2013 was less than that generated in 2012 (Sanaa et. al., 2015).A reduction of food waste by more than 50% from 2012 to 2013 was found for the months of April, May, June, July and October. On the other hand, December and January witnessed the least improvement in waste generation between 2012 and 2013. This could have been due to the fact that during December and January, many members of the Masdar Institute community are on vacation while others, who are around, have the time to go outside Masdar Institute and eat at other locations.

Food service organization:Previous studies on food waste control in hospitality's restaurant operations have shown that using smaller plates can lead to less food waste (Kallbekken & Sælen, 2013), but if the guests are able to use as many plates as they want, this strategy may not be very effective. In the traditional lunch buffet, it is interesting to note that so much of

the food went to waste despite the fact that the event had a full attendance rate (Sanaa et. al., 2015). This may have been because the guests had been at the venue from early that morning and prior to the lunch had had two coffee breaks. As a result, they were probably not very hungry by lunch time. Accordingly, to promote effective food waste management for a certain event, the chef could keep in mind the types of meals/refreshments being served to guests on a single day and their frequency, especially for the MICE industry which is becoming common across the world (Miller et. al., 2002).

Still in the study by Sanaa & Arafat (2015), B type properties worked on saving food to use in subsequent operations where HACCP restrictions permitted, and thus they used the untouched pastries from the breakfast to make a popular Arabic dessert. This shows how food waste minimization-promoting policies may be integrated into the strategy of a hotel and how effective using leftovers can be in reducing food waste. Certainly, it was amongst the strategies used by London restaurants to prevent 70 stones of waste (Houghton, 2014).

FOOD WASTES AND LOSSES IN RESTAURANTS

Jarie & Peter (2012) confirms that the hospitality's restaurant sector is no doubt, a significant producer of food waste, but there is a significant lack of reliable statistics on their avoidable food waste, and thus new studies are under way. However according to the schematic presentation of the food waste along the food supply value chain within the restaurants operations, food is received as ingredients and stored within the restaurant's main storage areas in which wastes and losses may be accrued as food storage wastes. The ingredients are thereafter issued, through raising a requisition note, in to production areas where food wastage is accrued via production wastes, while the finished product is passed over to the food service level, which may either be a' la carte or buffet, both of which generates two food waste types; wastes from serving dishes and waste from guest plates respectively, but at the same time also yields un-consumed food which, depending on the operational policy, may be given to staff, to charities for donation or saved for later use, but also generates waste to disposal (Sanaa et., al., 2015)as shown in the depiction of work flow in food service process.

*Purchasing and Storing:*Lam (2010) suggests that careful thought about menu design is one of the key ways to reduce waste and help realize cost savings. Thus the chef should adjust food purchasing policies to reduce excess food purchasing, and also apply the use of just-in-time purchasing software to reduce unnecessary purchasing in addition to adjusting menus to reduce frequently uneaten or wasted items (Tang & Tang, 2012)

Product shelf life can be maximized through proper handling of deliveries as bruised or damaged fresh products will result in extra waste. It's advisable therefore to check produce on delivery and return anything that is damaged (Gunders, 2012). Storing fresh products and raw ingredients in the most appropriate environment will increase their usable life. Furthermore, continual rotation of food ingredients- by arranging the latest product deliveries at the back of the shelf (application of the FIFO formula) is highly recommended (Oelofse, 2014). Products should be clearly labeled, with their purchase and best before dates. To help with accurate ordering try to place all the items of the same type (e.g. cans) from the same supplier on one shelf or in one area. This will enable you to easily see what you need, as you work towards 'just-in-time' delivery rather than pre-ordering in quantity, to help minimize storage costs and spoilage. Makani (2016) suggests considering a selection of airtight containers for cold storage of foodand keeping labels handy to mark dates, while dairyproducts, cooked meat, raw meats, fish and fruit andvegetables should be stored separately, again labeling food with the date going into the freezer andkeeping a list of frozen produce. Food frozen on site shouldalways be chilled in an appropriate piece of equipment,for example a blast chiller.

*Food Preparation/ production:*Food waste can be prevented through proper preparation and cooking methods and make a big difference to profit margins, and hence trimming of fish, meat and vegetables should be avoided by all means, although it's recommended to order pre-cut and trimmed items where possible (Makani, 2016), which is possible through such products as farmer's choice in Kenya. Accordingly, offer "skin-on" boiled, baked and roasted potatoes to reduce the amount of peelings you throw away (Bundhun, 2010). This on the menu may include items such as jacket potatoes, jacket arrowroots etc. The kitchen brigade should avoid pre-preparation of food which will spoil quickly, and store leftover food safely for use the next day where appropriate. Creativity with trimmings and excess in making pâtés, soups and stocks, while freezing excess berries for caulis or smoothies, and excess bread being made into bread crumbs or croutons is a plus to the kitchen crew, who ought to be trained to reduce prep waste and improper cooking (Schneider, 2015), for example, refine knife skills to have more efficient food preparation, and modify food preparation methods to minimize waste (for example, heat soups or prepare food in smaller portions).

Accurate portion control is paramount to reducing waste and increasing profitability (Gu, 2014). Not everyone eats the same amount of food, thus restaurants should consider offering different portion sizes on the menu so customers can choose how much they want to eat, while at the same timekeeping portions consistent by use of standard spoons and measures so that portion sizes don't slink up, for toddlers, children and lighter eaters. A standard portion of vegetables or side dishes should be

served but a second helping if the customer wants more offered. Staff should be encouraged to help customers order the right amount (Miller et. al., 2002) and monitor plate waste to help identify opportunities for savings as well as considering offering customers the option to take unfinished food home.

Identification of which buffet items are regularly wasted is necessary(Restaurant food waste action guide, 2018), and a reduction of the quantity of those items prepared, while at the same time implement tray-less system to reduce serving utensil size (Wolf, 2014). The menu items being wasted on a regular basis should be identified, and the quantity or portions of those items prepared reduced. Repurposing leftover kitchen food following food safety guidelines should be factored in the kitchen operational planning (for example, reuse day-old bread for croutons or leftover vegetables as a pizza topping)
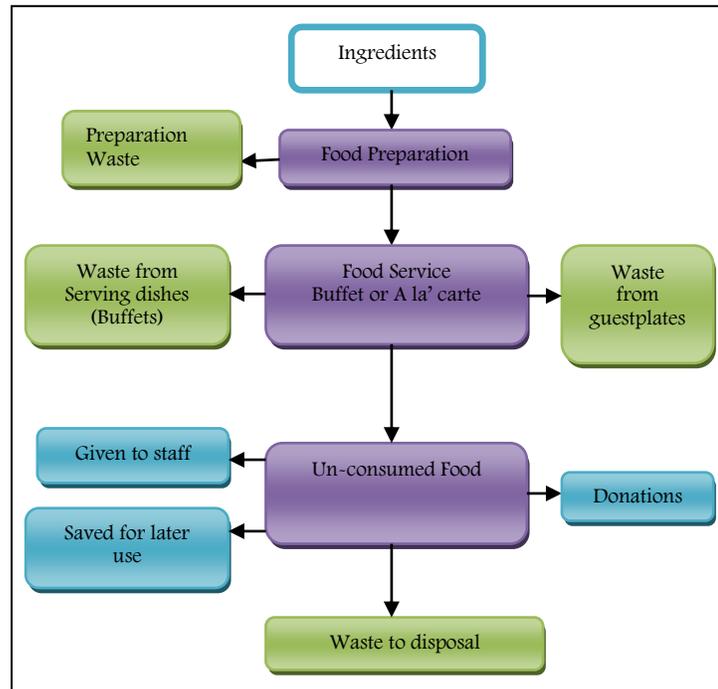

Fig 3: Depiction of material flow in food service process (Source: Sanaa & Arafat, 2015)

*Food Service:*Research reveals that meal leavers are more likely to want the full meal experience and therefore will order more courses (starter, main and dessert), while almost three-quarters of non-meal leavers (71%) just had a main course compared to just over half (54%) of meal leavers(High level panel of experts, 2014). As a result of meal leavers becoming satiated, they choose to leave food rather than order less. A study by Brooklyndhurst (2013) suggests that meal leavers either inaccurately judge the quantity they are able to eat or are more concerned about having the social experience (of several courses) than leaving food when eating out.The main dish and the accompanying side dishes were the courses most likely to be left; while appetizers, starters and desserts were less likely to be left (Brooklyndhurst, 2013), and thus the staple foods that were reported left at the end of the meal included chips, vegetables and salad. Chips, including garnishes, which are considered by some customers as plate fillers rather than part of the meal they ordered.

FOOD WASTE AND LOSS CONTROL

In an attempt to efficiently curb the food waste menace within the hospitality's restaurant business, most researchers have proposed the use of food recovery hierarchy(The restaurant food waste action guide, 2018) which proposes three levels of food waste and loss control; prevention, recovery and recycling. However, prevention deals with food wastes at the source and thus provides reliable solutions that prevent waste in restaurants, and with greatest economic value and net environmental benefits (Analysis of U.S Food waste among food manufacturers, retailers and restaurants, 2016) and therefore will be considered for this study. However, the restaurant food waste action guide (2018) also proposes the restaurant solutions matrix as a tool of food waste control, but basically leans towards profitability of the restaurant operations than food security, and at the same time, considered fit only for scholarly purposes as a result of its complexity, and thus may not be applied by hospitality's restaurant practitioners.
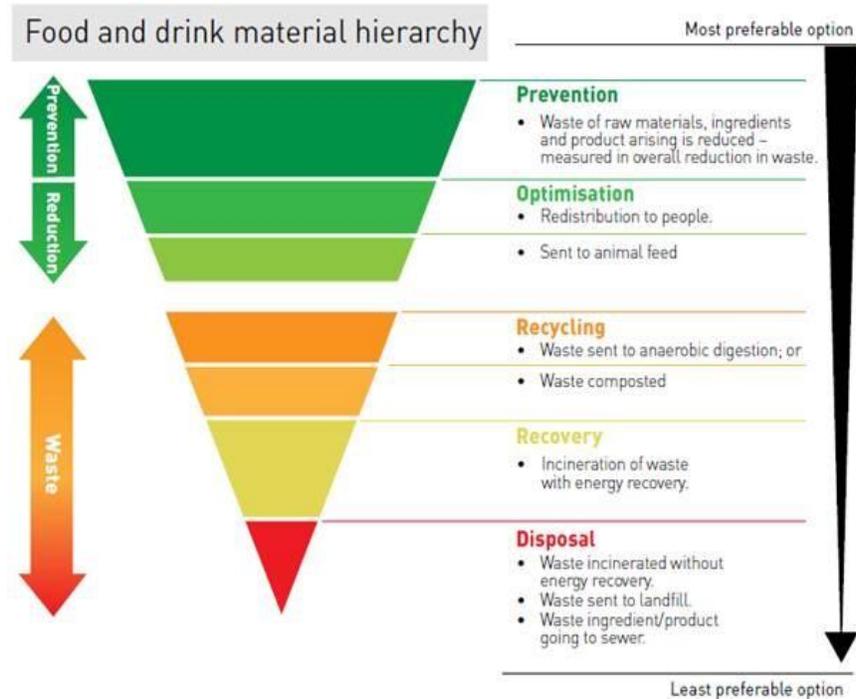
Fig 4:Food recovery hierarchy (Source; the restaurant food waste action guide, 2018)
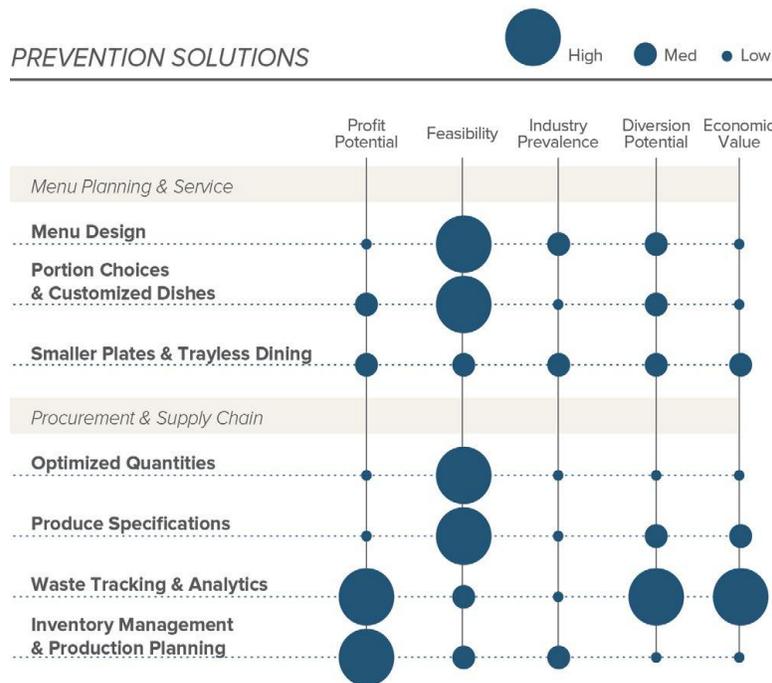

Fig 5: Food prevention solutions (Source; the restaurant food waste action guide, 2018)

From the prevention solutions proposed, two areas are highlighted as potential for food waste prevention or control within the larger hospitality's restaurant operations including; menu planning and service, which in itself includes menu design, portion choices and customized dishes as well as smaller plates and/or trayless dinning, and procurement and supply chain, which includes optimized quantities, produce specifications, and waste tracking analytics as shown in the graph below (The restaurant food waste action guide, 2018) as depicted in the food prevention solutions diagram in Fig 5.

The graphic presentation below is a summary of restaurant solutions in the approach against food waste and loss and thus food insecurity, and their dimensions: profit potential, feasibility, industry prevalence, diversion potential, and societal economic value (The restaurant food waste action guide, 2018). However, for purposes of this study, of importance are the prevention solutions against food waste depicted by the study graph 5. (Buzby et. al., 2012).

a.   *Menu Design:*Proper menu designing with food waste reduction in mind through reduction of the number of ingredients and repurposing food preparation trimmings as well as overproduction will lead to an increase in restaurants bottom line. Within the hospitality's restaurant operations, it may be achieved through; minimizing the range of ingredients used across dishes which maximizes opportunities for cross-utilization; use of different parts of a single ingredient in multiple menu items, seeking out opportunities to repurpose food preparation trimming and overproduction in other dishes, training all new culinary team members in optimizing food preparation, batch cooking, specific portion sizes, cross-utilization and repurposing of food trimming and excess food; indicating in recipe books how many portions should be delivered from packaged ingredients and/or how much yield a cook should expect to get out of a product, adjusting food production levels based on what is leftover at the end of the day, incorporating ingredients from standard menu items into specials or "limited–time offer" promotional items to reduce over ordering of limited-use food items and systemizing the best practices in operation and training manuals of the organization.

b.   *Portion Choices, Customized Dishes & Smaller Plates:*Offering multiple portion choices and a range of alternative sides to allow guests choose the meal that best suits their appetite and taste thus reducing post-consumer waste. Within the restaurant operations, provision of smaller amounts of a standard menu item with the option for refills, service to guests with exactly what they want as restaurants prevent surplus waste, offering a range of sides with mains and clearly indicating on menus what can be swapped out for other options so that guests are served the side that they are most likely to consume comprises of the alternative remedies against food wastes and losses. As a control measure, the restaurant may consider providing guests with smaller-sized plates with the objective of reducing the amount of food diners leave uneaten, which on average stands at 17% of their meals. Studies have revealed that smaller plates can reduce waste by 20% in buffet-style operations (The restaurant food waste action guide, 2018).

c.   *Optimized Quantities:*Working closely with suppliers and using food waste data to inform ordering gives restaurants the ability to: adjust pack sizes and order quantities, keep inventory low, minimize food waste, and order fresh food on a regular basis (The restaurant food waste action guide, 2018). In order to achieve this objective though, the restaurateurs are expected to engage with suppliers and negotiate deals that are best suited to menu and number of guests, in addition to varying packs sizes, which could include smaller minimum order quantities.Further, use of quality control assessments to share regular feedback with suppliers about product quality and specifications to improve ordering accuracy is important.

d.   *Produce* Specifications:It is also possible to employ off-specification produce which may be used as a lower-cost substitute for retail-grade since cosmetically perfect food lowers input costs without sacrificing quality in a restaurant setting; hence this act has been tested of being capable to realize $132 million annually in cost-savings (The restaurant food waste action guide, 2018). This aspect may be pursued via introduction of produce specifications that consider food waste reduction, such as acceptance of imperfect produce and pre-trimmed fruits and vegetables, thus integrating imperfect produce should always meet a restaurant's food safety and quality standards.

e.   *Waste Tracking & Analytics:*According to The restaurant food waste action guide, (2018), this waste solution, out of all solutions, offers the greatest business benefit to restaurants, almost $266 million per year, since tracking food thrown away has been found to cut food costs by 2 to 6% by increasing awareness of food waste within the company and focusing attention on front- and back-of-house prevention activities (The restaurant food waste action guide, 2018).It will therefore call for food waste audit to establish a baseline, thus the strong data acquired makes the case for investing in food waste prevention efforts and wins buy-in from the executive team and restaurant staff.

CONCLUSION

Food waste and loss remains a global threat to food security as it contributes to the diminishing of not only food resources but also other resources including water, money, energy, land etc. Thus, this is an area that has attracted international multidisciplinary research, with very little focus on the hospitality's restaurant operations in relation to food waste and loss. Nonetheless, the hospitality industry contributes considerably to the food wastes, and at the same time is growing rapidly thus recording a proportionally and statistically significant food wastes and losses. Studies have classified three areas of food wastes and loss within the hospitality's restaurant operations including food preparation and production, food spoilage and customer plates, in which specific efforts through control measures should be instituted. Further, all the five food classes; vegetables and fruits, farinaceous foods, meats, legumes, milk and eggs are all at risk of waste and loss throughout the global food supply-value addition chain within the restaurant operations. Thus in view of the global input of restaurants towards

food waste, urgent control measures should be instituted to prevent the escalation of this food waste into food insecurity which is currently a nightmare to all countries of the world.

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