ENVIRONMENTAL ASSESSMENT ON DAILY OPERATIONS OF CAFÉ AT KOTA BHARU DISTRICT

ABSTRACT

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Food loss can occur along the way of the whole food supply chain. Apart it is not acceptable from an ethical point of view, food losses can create negative impacts towards economy and environment as well. Globally, food service industry is the third biggest providers to food waste, right behind household and agricultural sector. Café house as one of sub-provision of food service sector are growing worldwide and currently become a trend among Malaysians. Thus, this study was intended to explore the environmental assessment on daily operation of the café houses. Five cafés with same criteria requirement were selected to get a reliable data regarding food wastes within the sector. The waste from five selected cafés was classified into three categories which are preparation loss (PREP), serving loss (SERV) and customers' plate loss (PLATE). Three bins were provided and labelled to differentiate the loss categories. Next, carbon and water footprint were developed using specific formula. All the data were measured continuously for a period of 7 days. Material Flow Analysis was used to visualize the flow of material from the cafes' operation. The study found out that the PLATE waste showed almost doubled fraction (13%) of the PREP waste (7%). 969 kWh average of electricity consumption was recorded from the five selected cafes, which produce approximately 103.93 $kgCO_2e$ of carbon footprint. Average total water consumptions from the five cafes were 24.4 m^3 that can cause about 8.39 $kgCO_2e$ of carbon footprint. This study help café management to recognize the areas for improvement on reducing food waste generation.

Keywords: Material Flow Analysis, carbon footprint, food waste, food service, café

1.0 INTRODUCTION

Food waste is a main concern that allied to a set of auxiliary worldwide socioeconomic and environmental challenges (Segre et al., 2014). Based on Food and Agriculture Organisation (FAO) of the United Nation, nearly 1.3 billion tonnes of food is cast-off globally per annum, with one third of all food are for human consumption. Malaysia alone bins up about 16,688 tons of food daily which is enough to feed 12 million people a day (SWCorp, 2017). This global problem is recognized to give impacts on the environment such as greenhouse gas (GHG) emission from the decomposition of food waste in landfill, and emission of environmental footprints such as water and carbon footprint. Food waste from food service industry denotes an issue of particular concern due to its contribution of the highest waste generation compare with other industries (Pirani & Arafat, 2016).

Heikkilä et al., (2016) in their study mentioned that waste from food service sectors often derived from two main groups which are wastes that are left before consumed (pre-consumption waste) and wastes after consumed (post-consumption waste). Pre-consumption waste usually occurs during food preparation process mainly raw food such as fruits or vegetables peel, root from leafy vegetables, eggshells, seafood shells accidently spilled food or fluids, and improperly prepared food. Meanwhile, post-consumption waste is any uneaten food such as bones, vegetable, seafood shells or any leftover existed on the customers' plate. The discarded food has causing not only environmental and health issues but also lead to waste of environmental costs such as water, energy and transport costs (Evans et al., 2013). This is because, once the food is wasted, all the resources for processing and preparation of the food also wasted.

The food service industry comprises of cafes and bar, fast food chains, self-service restaurant, full-service restaurant, home delivery and take away, as well as street kiosks (Agriculture and Agri-Food Canada,2014). These numerous options of eateries ultimately will result in food waste. Café or coffee house that mainly served coffees (Chisnall, 2017) represent an international food service sub-sector plays a gradually vital role in society well-being and economies. Nowadays, café shops are booming at all over the place. Onag, (2011) mentioned that cafes' patrons' visitation in Malaysia has increased year by year since 2007. Thus, café houses play an important role in reducing food waste from how source produce, develop menu to how to manage the leftovers and customer plate waste.

Given the café produces significant economic values, unexpectedly it has been remained academically unexplored predominantly in the matter of environmental performances. Apart from the historical outlook on the café's derivation and development (Cowan, 2008), current studies on café house have engrossed on patrons' loyalty, customers' preferences, and brands' perception (Tumanan and Lansangan, 2012; Shin et al., 2015; Won et al., 2018). Research also viewed on how café discourse the trend of modern-day marketplace concerning market division, adoption of technology and changing patterns of café use (Tan and Lo, 2008). This situation represents a critical gap. Therefore, this study conducted to explore the environmental assessment of café daily operation by implementation of Material Flow Analysis (MFA). Through this study, flow and pathway of the waste generation from cafes can be identified. Possible environmental impacts such as carbon footprint also can be recognized. Therefore, it will benefit café management to spot the areas for enhancement to reduce food waste.

2.0 METHODOLOGY

The methodology used for environmental assessment of daily operation in cafés acquired four phases. It started with Phase 1 (Preparation), Phase 2 (Implementation), Phase 3 (Waste Collection) and Phase 4 (Data Analysis). The summarized study phases were described as in Figure 2.1. Figure 2.2 illustrates a detailed data collection plan for methodology flow in assessment on daily operations of cafes.

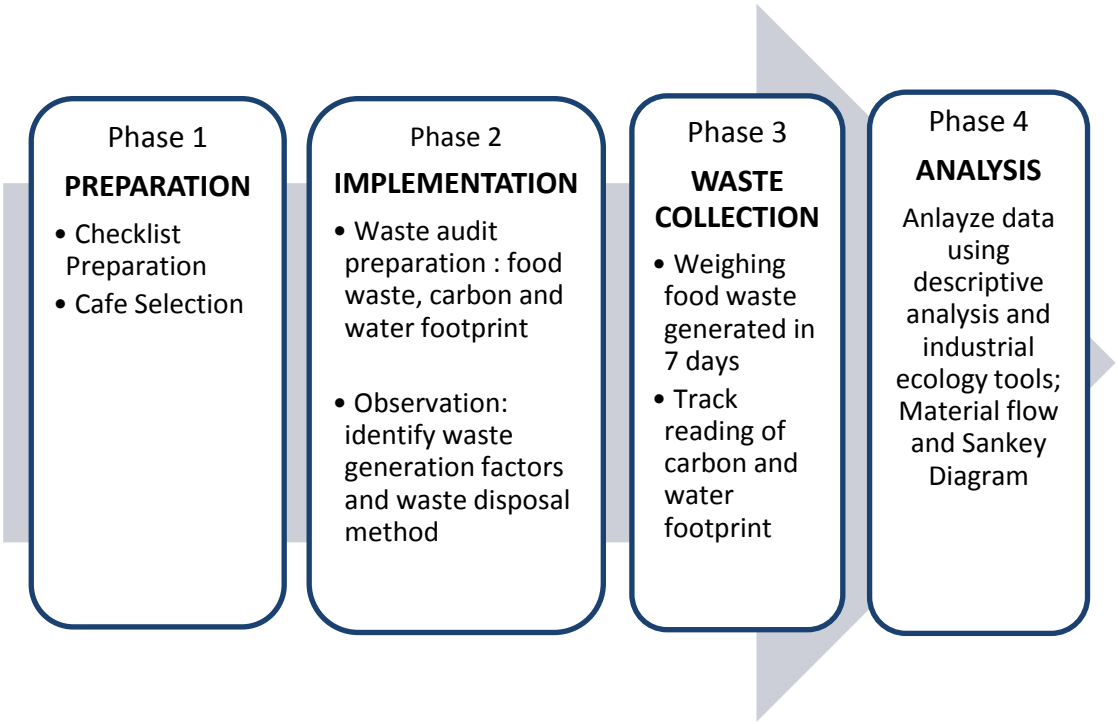

Figure 2.1: Study Phases

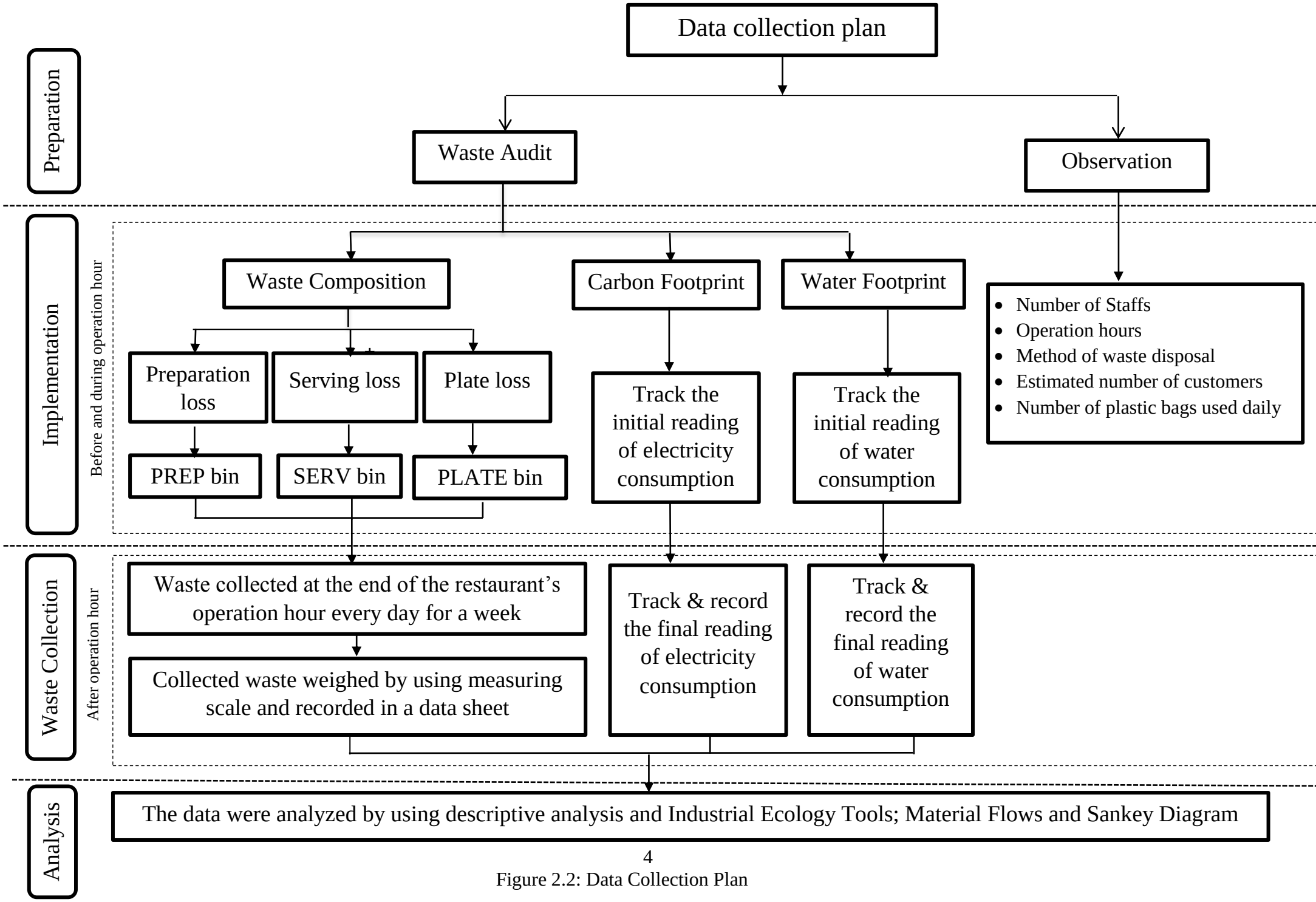

Figure 2.2: Data Collection Plan

2.1 Phase 1: Preparation

Five cafés in Kota Bharu, Kelantan were chosen based on study selection criteria such as location, average number of customers (more than 50 customers daily) and its operation hours (morning until midnight). Then, a well-designated checklist was prepared (Appendix I). The checklist consists of the data such as:

- Number of staffs
- Operation hours
- Method of waste disposal
- Estimated number of customers
- Electricity and water consumption

2.2 Phase 2: Implementation

In this phase, a waste audit on food waste generated from five selected cafes was conducted. According to the Betz, et al. (2015), losses can be divided into four categories which are storage losses (STOR), preparation losses (PREP), serving losses (SERV) and plate waste (PLATE). In this study, it only focused on three categories of losses which are:

i. Preparation loss (PREP): losses during food preparation and cooking including fruit and vegetable peels, spoiled or dropped food (collected in during the preparation process)
ii. Serving loss (SERV): food remaining from the buffet and serving bowl (collected after operation hours)
iii. Plate waste (PLATE): food remaining on customers plates (collected after operation hours)

The bins were labelled to distinguish the food waste from these three different loss categories. The initial reading of electricity and water consumption were recorded before the cafes' operation started to get carbon footprint data. Visual observation was carried out to observe and analyse the waste generation factors and disposal technique during the operation hours based on the checklist that have been prepared before.

2.3 Phase 3: Waste Collection

Waste collection phase was carried out after the operation hour of the cafés. Onsite weighing the food waste from the PREP and PLATE stages were carried out using a weighing scale. Also, the final reading of daily electricity and water consumption were tracked. During this phase, the amount of food wastes, electricity and water consumption were measured daily, continuously for one week in order to account for daily variation. All the data obtained were recorded in data sheet (Appendix IV).

2.4 Phase 4: Data Analysis

Total amounts of food wastes from each stage were sum up and reported as percentage of total weight of food waste. Food waste generated in cafes were documented and linked to specific type of loss category such as PREP loss, SERV loss and PLATE loss. MFA was developed to visualize the flow of the food waste produced and to identify which loss categories thrown out a huge amount of food waste. Electricity and water consumptions data were used to analyse the carbon footprint emission using a specific formula (Mekonnen and Hoekstra, 2010, 2011).

2.5 Quantification of Carbon Footprint

Carbon footprint (CF) refers to other cumulative amount of GHGs emission mainly cabon dioxide (CO_2) associated with a person or other entity over its product lifecycle from production, distribution, consumers and disposal (Noelle, 2019). For calculating the carbon footprint, two main parameters are needed. First is activity data (AD) which demonstrate the process quantification. Meanwhile, the second parameter is emission factor (EF) to show CO_2 equivalent emission that is emitted for a unit of AD. Carbon footprint generated from the food waste was calculated using equations generated by Malek and Kumarasan (2019). The equation (1) are:

$$\text{Carbon footprint } (kgCO_2e) = \text{Activity Data (AD)} * \text{Emission Factor (EF)} \quad (1)$$

The emission factors used in this study are shown in Table 2.1.

Table 2.1 Emission Factor for each activity data

Activity Data	Type	Unit	GHG	Emission Factor
Electricity	Malaysia (commercial rate)	Kilowatt-hours (kWh)	kg CO2 e	0.10919
Water Consumption	Water Supply	Cubic meters (m3)	kg CO2 e	0.344

A study conducted by Hill,(2011) stated that the emission factor values for each activity data were obtained from direct process measurement or publicly available data such as GHGs conversion factors from United Kingdom Department of Environment, Food and Rural Affects (Defra) or Department of Energy and Climate Change (DECC).

3.0 RESULT AND DISCUSSION

3.1 Food waste generation by different loss categories on daily operation

This study aimed to determine the generation of food waste by different loss categories which are PREP, SERV and PLATE loss on the daily operation of cafés. The result specified in this section is based on the weight of food waste immediately after it was collected using a weighing scale. Raw data obtained are in Appendix II. The daily averages from the five cafes were portrayed in Table 3.1.

Table 3.1: Daily average of food waste amount generated from five cafés according to loss categories

Loss Category	**Day/kg**							**Average Total Weight (week/kg)**
	1 (Wednesday)	2 (Thursday)	3 (Friday)	4 (Saturday)	5 (Sunday)	6 (Monday)	7 (Tuesday)	
PREP loss	3.84	5.86	8.53	7.27	5.43	5.52	4.16	40.60
PLATE loss	6.84	12.23	21.02	17.71	9.98	10.08	8.36	86.23
Total (day/kg)	**10.68**	**18.09**	**29.55**	**24.98**	**15.41**	**15.6**	**12.52**	**126.83**

*Serving loss is not applicable for this food service setting

Within the time period of data collection, the study showed that 621.81 kg of food in total was thrown away from five selected cafes with an average 126.83 kg per café. The study found out that the food wastes in cafés were derived from two main loss categories which are PREP loss and PLATE loss. SERV loss was not applicable for this study because there was no food discarded from the serving loss

within the time food waste audit performed. In the period of one week, 40.60 kg and 86.23 kg of food was discarded from PREP and PLATE loss respectively.

This study was conducted in Kelantan State, thus the weekend is on Friday and Saturday where, Friday is the first day of the weekend and Saturday is second day of weekend. The highest waste generated was recorded on weekend (Friday) which is 29.55 kg and the least was on weekday (Wednesday) with 10.68 kg. PREP loss was the peak on Friday which is 8.53 kg, and the least was Wednesday which recorded 3.84 kg. For PLATE loss, the greatest amount of food waste generated was 21.01 kg which is also on Friday and the lowest was on Wednesday with recorded the waste only 6.84 kg.

The amount of food waste generated might be linked to the total number of patrons during the selected timeframe. This trend of customers' visitation was due to the day of the week. From the observation during cafes' services, on the weekend, customers' visitations were partially increased to half compare on weekdays. The biggest food waste generated was on Friday which is 29.55 kg. This result indicates that Friday was the highest consumers show-up due to weekend operation. Sasson, (2018) stated that people love to dine out on weekend to have fun and pleasure after working for the whole week. During the weekend, diners tend to bring family and friends for gathering and celebrating special occasion. Thus, it can lead to order more food than actually needed to fulfil each person's craving. Therefore, more amount of food is being wasted. Weekdays showed less customers' visitation. According to the owner of the café, generally customers only take away food and asked for delivery service during the weekdays. It can be seen from the study, due to weekday

operation, Wednesday was the lowest customers load during the whole period under investigation thus the amount food waste recorded only 10.68 kg.

3.2 Material Flow Analysis (MFA) on daily operations

The study then detailed regarding the MFA study that have been conducted to monitor the amount of food waste generated from different food loss categories. MFA has been used broadly in waste management. Several studies have implemented MFA as a support decision tool in food waste management such as in school canteen (Kim,2013), in foodservices at education and business sector (Betz et al., 2015), as well as in hotel and restaurant (Pirani & Arafat, 2016). The application of MFA in this study was to visualize the material flow and pathway taken place in the cafés. The results were presented in percentage and in the form of Sankey Diagrams as in Figure 3.1. The links thickness signifies the amount of flow from a source to the target node which is from total waste input to food consumed, preparation and customers' plate loss.

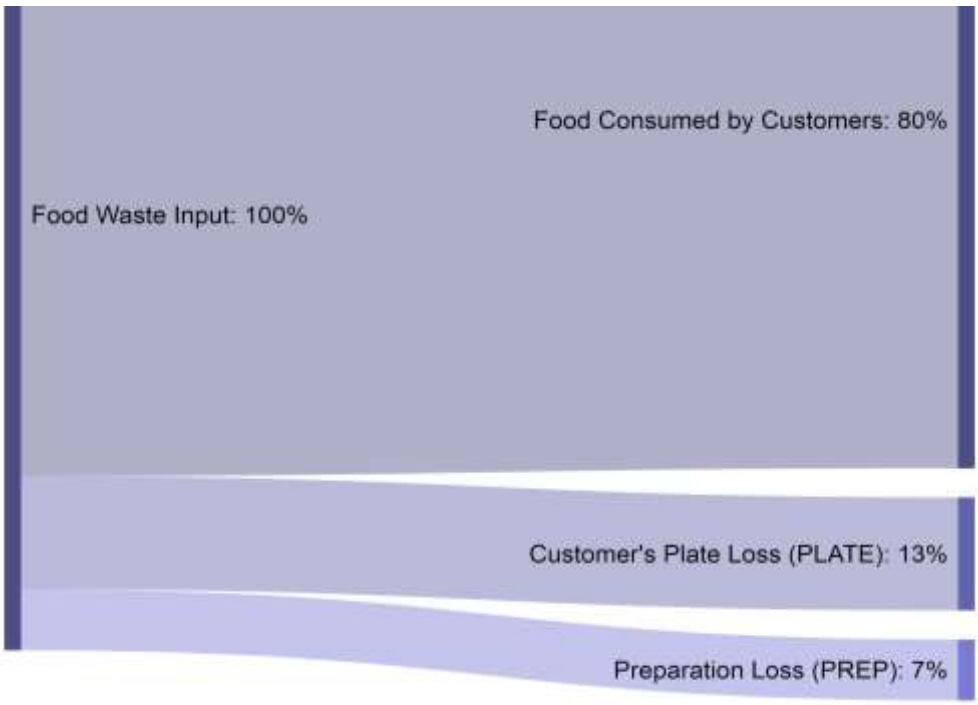

Figure 3.1: MFA Sankey Diagram for different food loss categories

From 100% of total waste input, roughly 80% of foods succeed to devour by the customers. It is clear showed PLATE waste from the cafés tended to be more significant compare to PREP waste. It can be seen that the PLATE waste exhibited almost to double (13%) result of PREP waste which is only 7%. Some analogous results were obtained from Betz et al., (2015), Papargyropoulou et al., (2016) and Pirani & Arafat, (2016) which shown that the customers were the main contribution of higher food waste generation compare to other food loss categories. This study perceived plate waste as a vital category, emphasizing that customers are one of the core parts to focus in the drive to diminution of food waste.

PLATE loss was a critical component in cafes' food waste as it is does not have opportunity to rescue. The PLATE loss generally interrelated with the consumer's attitude and behaviours (Drewitt, 2013). Most of the foods served in cafes were *ala-carte* type which means cafés offers an individual dishes. Other study found that *ala- carte* type can aid to reduce food waste (Lam, 2010). However, this study showed *ala-carte* service style causing the patrons have the behaviour for over-ordering of different varieties of food in one time. Conversely, the ordered foods were unable to finished and lastly ended up in bins. Betz et al., (2015) conducted customers survey using questionnaires revealed that the major cause of PLATE loss were due to large serving portion and lack of hunger. This related to the carbohydrates food served which from the observation, "meal-leaver" tends to leave the plate with lots of carbohydrates food such as spaghetti, pasta and fries. This fact was supported by Engstrom and Carlsson, (2004) and Al Domi et al., (2011) which stated that plate waste was discovered to consist of starch accompaniment followed by vegetables. The patrons, usually youngsters attracted to cafe house due to

“instagrammable” foods and beverages served as well as the unique café style. Cafés nowadays are no longer a place to appease the hunger, but it is an attractive place for socializing, photographing before posting on social media platforms (Hairon et al., 2017). Thus, this situation becomes a big reason for PLATE waste where people went to café because lack of hunger and just for a photo.

Pre-consumed waste or PREP loss typically arises when processing raw materials in the kitchen before it is served to consumers. The food wasted from PREP loss has a low potential to control or for waste reduction compare to PLATE loss category. This is because, the waste generation created during PREP stage are generally unavoidable losses that are not edible in normal circumstance. For instance, fruits and vegetable peels, egg shells, bones are commonly derived from PREP stages where it is not fit for consumption. The avoidable food wastes are rarely to occur in PREP stage except if the losses are due to imprecision in handling raw materials during food preparation such as spilled and spoilt of raw materials. Avoidable food waste applied to food that was intended for consumption nevertheless it cannot be eaten anymore because of shelf-life regulation, hygiene rules, quality requirements and most often issue is due to diners’ habit (Betz et al.,2015). In this study, avoidable food waste can be seen in PLATE loss where consumers tend to leave their plates with eatable waste that can be evaded.

There was no food is wasted from the serving category (SERV) during the period of this study was performed. Betz et al., (2015) mentioned that SERV loss specify the food left from the buffet and serving bowl at the counter. In this study, the SERV loss means the foods that remain in the display chiller at the counter. The foods served in display chiller in the cafés are typically desserts such as cakes, tarts,

pies and others. The counter top is kept for pastries, butter cakes, muffins which need to be consumed at room temperature. From the observation, SERV foods such as quiches and croissants were sold out within the day. Meanwhile, items in display chiller were normally sold out within one or two days after restocked. According to the owner of the café, generally the foods served in display chiller specifically cakes are last for three days and for items in counter tops normally have the shelf life for one day. Thus, they were not dispose any food from SERV category as it completely sold out within the shelf life of the items. If there were some leftover, the owner of the café will offered to the staffs.

3.3 Amount of carbon footprint emission from daily electricity consumption

As stated before, this initial study is done to estimate the CO_2 production by the daily operation of the cafés. One of the focal sources that is releasing great amount of carbon in cafes' operation is electricity which is gained from the electricity consumption. The electricity consumptions in five selected cafes were obtained from the reading of electricity meter during operation hour and after operation hour daily for one week. The daily electricity consumptions in five cafes were presented in a kilowatt-hour (kWh) and the raw data collected are in Appendix III. Figure 3.2 gives information about the average of daily electricity consumption from five selected cafés in Kota Bharu District.

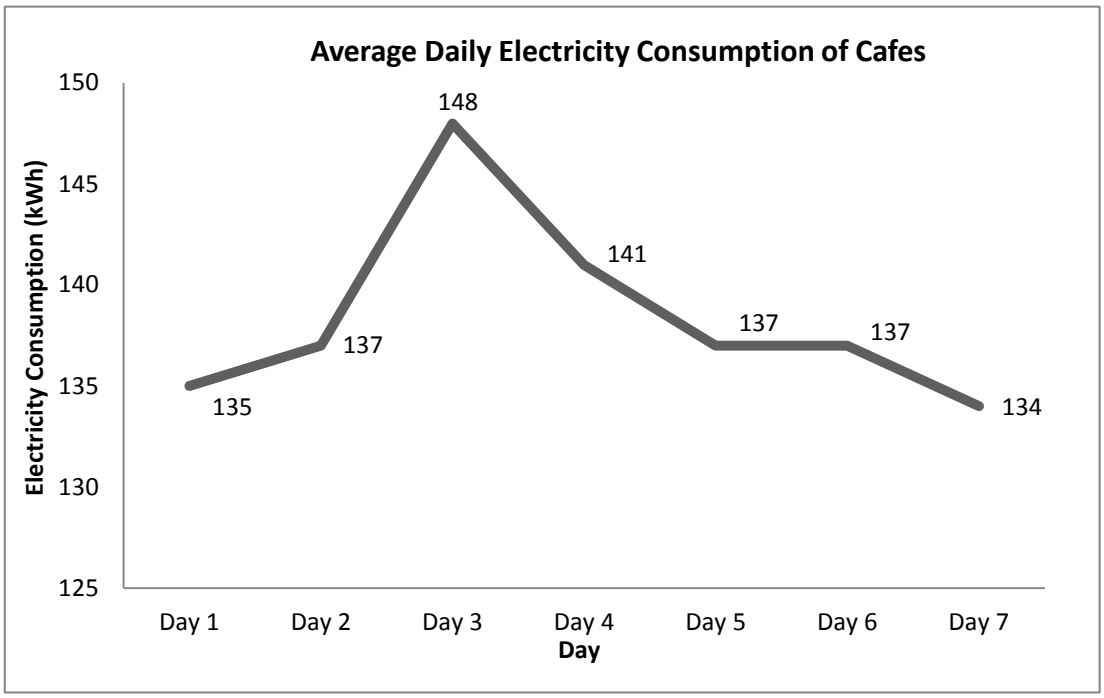

Figure 3.2: Average daily electricity consumption from five selected cafes

It can be seen that the largest use of daily electricity consumption were on Friday (Day 3) which recorded 148 kWh. Meanwhile, 134 kWh was the lowest which is on Tuesday (Day 7). Friday (Day 2), Sunday (Day 5) and Monday (Day 6) recorded the identical average daily usage of electricity which is 137 kWh. From the daily electricity consumption that was collected, the calculation of CO_2 emission is carried out using the equation (1) with an emission factor for electricity consumption. Units are measured in $kgCO_2e$. The results are then charted in Figure 3.3.

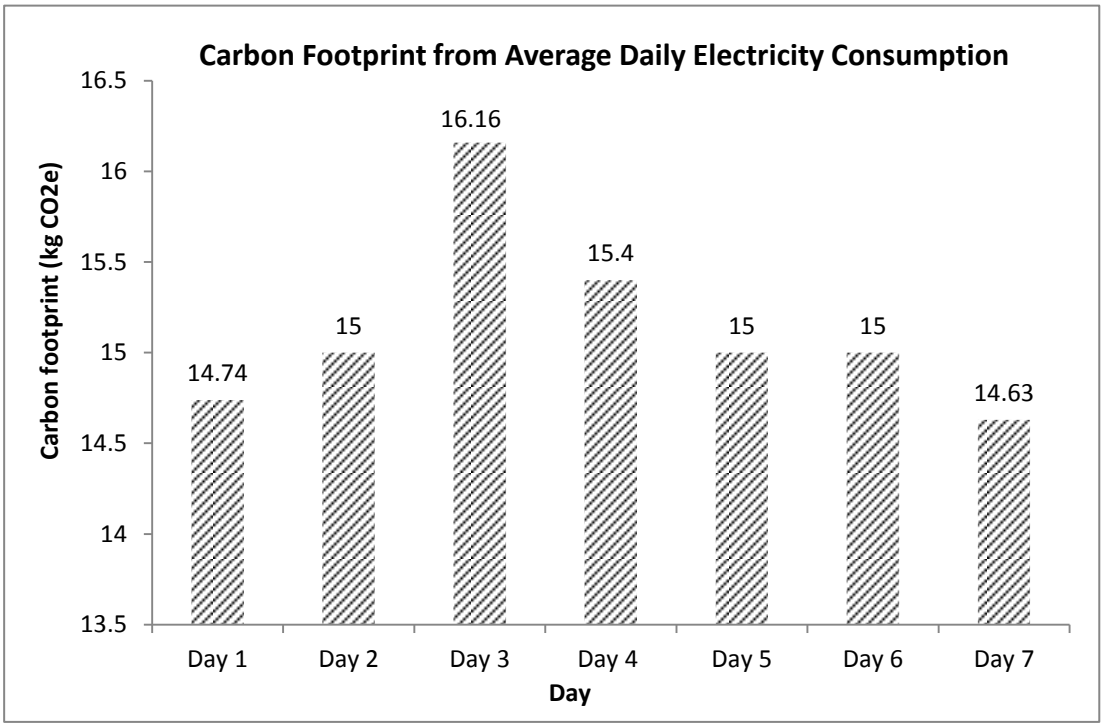

Figure 3.3: Average carbon footprint generated from electricity consumption of cafes

Overall, the amount of carbon footprint arising from electricity consumption was increase from Wednesday (Day 1) to Friday (Day 3) and fell steadily over the next four days from Saturday (Day 4) to Tuesday (Day 7). The highest amount of carbon footprint can be seen in weekend (Friday and Saturday) which the reading 16.16 $kgCO_2e$ and 15.40 $kgCO_2e$ respectively. Meanwhile, the lowest was 14.63 $kgCO_2e$ on weekdays which was Tuesday (Day 7). Thursday (Day 2), Sunday (Day 5) and Monday (Day 6) shows a similar amount of carbon footprint generated which is 15.00 $kgCO_2e$.

By far, carbon footprint has turn into the utmost broadly used indicator to measure the food service contributor to the greenhouses effect. Food service amenities are extremely energy demanding, where it spend three times more energy than other commercial buildings. About 80% of that energy does no useful work and

is wasted through surplus heat and noise from ineffective appliances, heating ventilation and air conditioning systems as well as lighting and refrigeration (Danuta et al., 2015). Liam Hallam, (2020) stated that the main electricity uses in a general restaurant are due to cooking and refrigerator then followed by cooling, interior and exterior lighting and also, ventilation. In this study, the highest usage of electricity can be seen from cooking process in the kitchen area. This is because, the preparation and cooking of the dishes mainly use electrical equipment and appliances. For example, as café shop predominantly served coffee as their flagships product, thus the used of Coffee Making Machine for the whole operation hour is a must. Furthermore, the refrigerator and display chiller need to operate for 24 hours per day including during non-operating hour to prevent the spoilage of the raw material or food displayed.

According to Danuta et al., (2015), lighting accounts for 6% of CO_2 emission. Thus, exterior and interior lighting plays an important role in increasing the amount of electricity consumption. From the observation, all the five selected cafes were using air conditioning as their ventilation system. This situation requires a huge amount of electricity to operate the system. The number of visitors to the cafes also can be related to electricity consumption. By cause of more customers' visitation, the usage of electrical equipment and appliances in café will upsurge and thus increase the electricity consumption. This can be proved where the highest amount of electricity consumption was on Friday which is Day 3 (148 kWh) where the number of customers were the highest. This great amount of electricity consumption will lead to the great amount of carbon dioxide (CO_2) generated in the cafes. In this study, a total 969 kWh of electricity consumption were recorded within 7 days, which

produced approximately 103.93 $kgCO_2e$ of carbon footprint from daily electricity consumption.

3.4 Amount of carbon footprint emission from daily water consumption

Other sources that can emit the huge amount of carbon in cafes' operation are from water consumption. Water consumption in five selected cafes was obtained from the reading of water meter prior to the operation hour and after operation hour in the period of days. Daily water consumption in five cafes was presented in a meter cubic (m^3). Figure 3.4 gives information about the average of daily water consumption from five selected cafés. The raw data of daily water consumption from five cafes are in Appendix III.

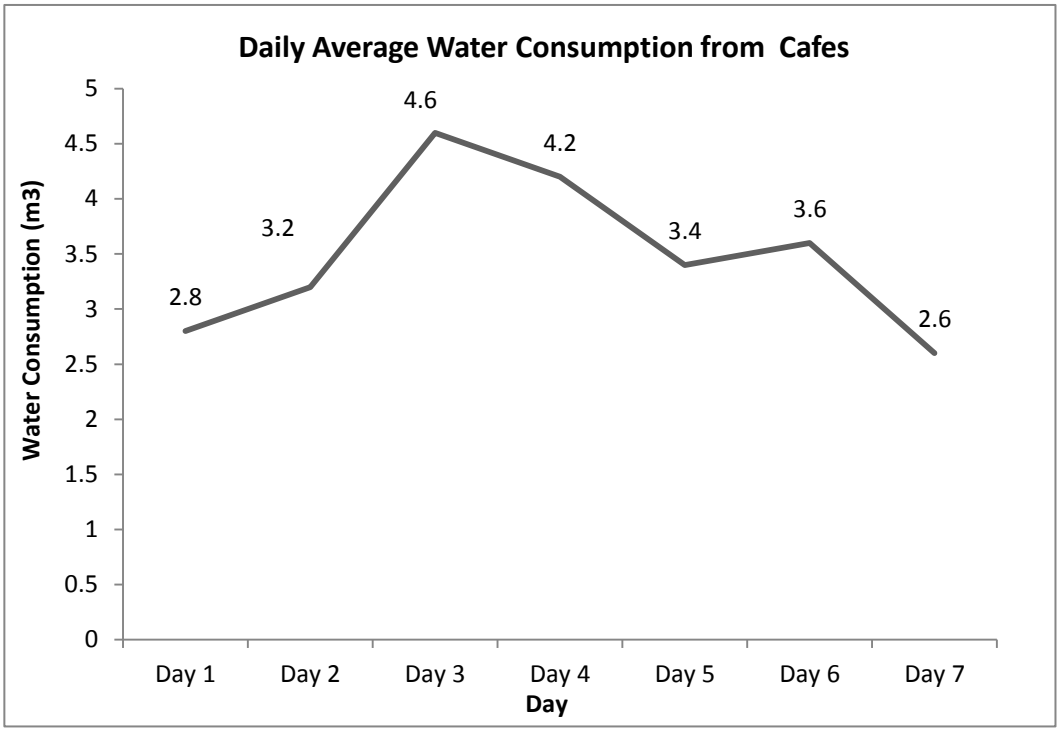

Figure 3.4: Average daily water consumption from five selected cafes

It is clearly indicate that the highest amount of water usage for daily operations in five cafes are on Friday (Day 3) and Saturday (Day 4) which recorded 4.6 m^3 and 4.2 m^3 respectively. The least daily water consumption was on Tuesday (Day 7). From the daily usage of water, the calculation of the carbon footprint arising from was calculated using an equation (1) but replaced with emission factor for water consumption. Units are conveyed in kilograms of CO_2 equivalents ($kgCO_2e$). The results are then tabulated in Figure 3.5.

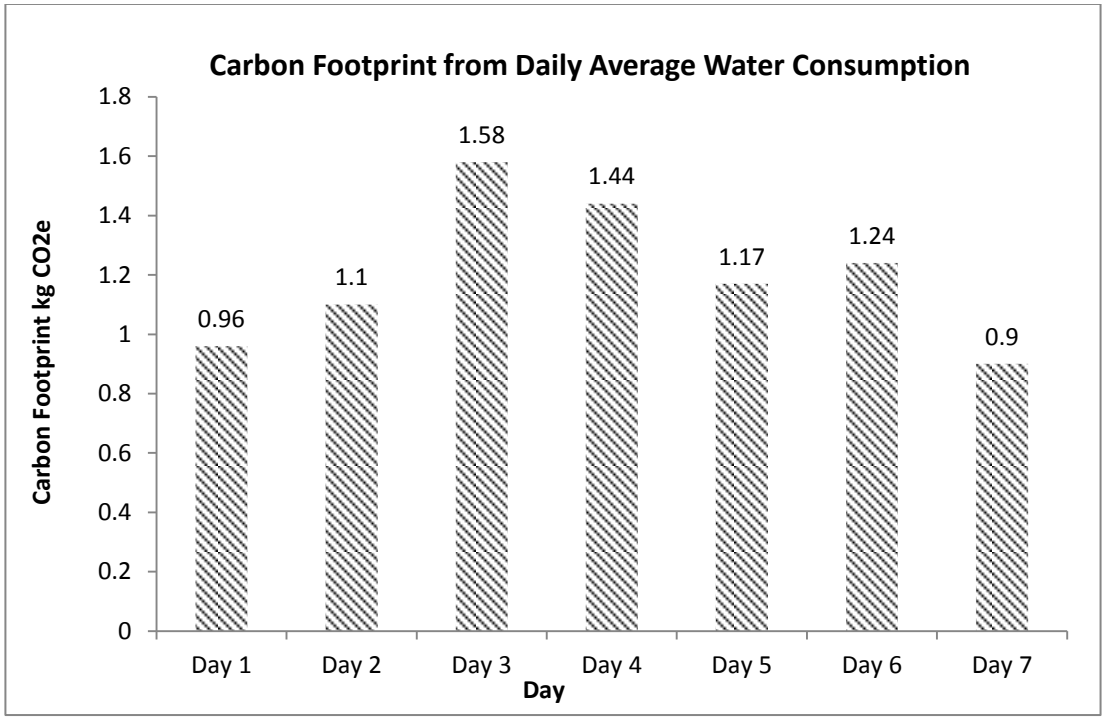

Figure 3.5 Average carbon footprint generated from water consumption of cafes

The most generation of carbon footprint arising from the usage of water was on Friday (Day 3) which is 1.58 $kgCO_2e$ followed by 1.44 $kgCO_2e$ that is on Saturday. The minimum amount of carbon footprint was on Tuesday (Day 7) and Wednesday (Day 1). Thursday (Day 2), Sunday (Day 5), and Monday (Day 6) showed an average reading of carbon footprint which is 1.1 $kgCO_2e$, 1.44 $kgCO_2e$ and 1.24 $kgCO_2e$ respectively.

According to EPA, the water used in food services industries describes approximately 15% of the total used in commercial and institutional facilities. The availability of clean water is important for coffee shop industry because the water itself is the fundamental for the producing a good quality of coffee; from coffee beans until it served (Hendratno et al., 2018). In café, water is not only used for brewing the coffee, but use for other activities such as cleaning, dishwashing, and restroom (Fasman, 2015). Café use a huge amount of water consuming due to strict Standard Operating Procedures (SOP) where it required to wash all the existing equipment on bar, and other supporting equipment. The support equipment includes the base to put the glass, display food and also equipment to complimentary materials such as chocolate and caramel sauce, green tea powder, and others. These strict SOPs are crucial to maintain the hygiene of the café is at optimum level. This study recognized that the number of customers were at the highest on weekend which is on Friday (Day 3) and Saturday (Day 4). Thus, on weekend, according to the increase number of patron's visitation, the water consumption also increases. This situation indirectly affects the carbon footprint result too. In other words, these three items have a sturdy relationship with each other.

4.0 CONCLUSION

Food waste can occur along the way of the food supply chain either latter or earlier stage of the chain. The food waste will end up in landfill, creating greenhouse gases that could lead economic, environmental and health problems. This study has approached the food waste issue in the food service sector specifically in the café house. It aimed to determine the environmental assessment of daily operations in café. This aim was met by 1) implementation of MFA to different types of loss categories such as preparation, serving and customer's plate loss 2) assessment of carbon footprint.

The study found out that the daily generation of food waste in cafés were depends on the day of the week. The amounts of food thrown away from cafes' daily operation were more on weekend compare to weekdays. This statement can be seen from the result that showed the highest average food wastes generated from five selected cafés were on weekend (Friday and Saturday) which recorded 29.55 kg and 24.98 kg respectively. Meanwhile, the least was on Wednesday which is only 10. 68 kg. Weekend also showed the huge amount of the food being discarded due to the large number of customers show-up. As to weekdays, the patrons usually "take-away" and order through delivery services.

Through the MFA that was performed as part of this study, it was identified that PLATE loss was the most significant compare to PREP waste. It can be seen that the PLATE waste showed almost to double result of food discarded from PREP loss. In order words, customers are culpability for the majority of the food waste generation in cafés. The study identified that the contributing factors of the higher food waste from PLATE loss due to several reasons such as customers' attitude and

behaviour that tends to over-ordering, large portion size, and lack of hunger. The waste from preparation stage is usually unavoidable as it not edible in normal circumstance. Thus, the waste reduction from PREP loss is difficult to carry out. Since the waste from PLATE loss were very significant, therefore approaches which help to reduce this type of waste need to be implemented.

Footprint concept has been effectively used to define the effect of production and consumption. Daily average for electricity and water consumption were recorded to regulate the total carbon footprint emission from the cafe. Compare to weekdays, weekend (Friday and Saturday) displayed huge amount carbon footrprint emission from both electricity and water consumption. Electricity consumption were at peak on Friday with 148 kWh usage which emitted 16.16 $kgCO_2e$ of CO_2. Meanwhile, carbon footprint from water consumption shown the highest water usage also on Friday which is 4.6 m^3 that causing the generation of CO_2 about 1.58 $kgCO_2e$.

Carbon footprint emission can create negative impact on envrironment such as release of GHGs that initiate global warming. The measures of using energy-efficient appliances, and water conservation capable to reduce the operating emissions. Moreover, this study provide an opportunity to recognized the sources of food waste generation thus, the proactive plans and strategies for plummeting food waste generated in café houses can be established.

Further research is needed to explore more regarding the food waste within different sectors. This study mayhap enriched by including the types of food waste generated from different food waste loss to acquire better unswerving data concerning the total food waste in restaurants. Furthermore, when categorized the

food waste based on its specific types, the water footprint emission derive from food waste can be premeditated. This study does not provided the detailed image of food waste generation created in restaurant but it provide opportunities for testing how this variables affect the generation of food waste.

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APPENDICES

Appendix I

CHECKLIST FOR WASTE AUDIT

Type of food establishment: ……...…

Name of food establishment: …….Date of Audit: ……

Part A: Administrative Data	
Operation hours	
Number of staffs	
Estimated daily number of customers	
Is on-site waste composting available?	Yes ☐ No ☐
Number of Daily Single Use Plastic	Plastic bag ☐ Plastic containers ☐

Part B: Daily Electricity and Water Consumption

A) Daily electricity consumption

Day	**Initial meter reading (A) (kWh)**	**Upon closure meter reading (B) (kWh)**	**Actual consumption (A-B) (kWh)**
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			
Total Weekly Electricity Consumption			

B) Daily water consumption

Day	**Initial meter reading (m^3)**	**Upon closure meter reading (m^3)**	**Actual consumption (m^3)**
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			
Total Weekly Water Consumption			

Part C: Onsite Food Waste Audit Data

Losses Category	**Day/kg**							**Total Weight (week)/kg**
	1	2	3	4	5	6	7	
Preparation Loss								
Serving Loss								
Customer's Plate Waste								

Appendix II

RAW DATA OF FOOD WASTE GENERATION FROM PREPARATION LOSS

PREP Loss	Day/kg							Total weight (week/kg)
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	
Café A	3.40	5.80	6.00	6.25	3.00	5.60	3.50	**33.55**
Café B	5.40	3.20	6.50	6.20	4.76	4.10	3.30	**33.46**
Café C	3.30	10.20	12.21	7.30	4.80	5.60	7.00	**50.41**
Café D	2.90	3.40	4.70	3.90	6.30	6.90	3.50	**31.6**
Café E	4.20	6.70	13.25	12.70	8.30	5.40	3.50	**53.97**
TOTAL (Day/kg)	**19.20**	**29.30**	**42.66**	**36.35**	**27.16**	**27.60**	**20.80**	**202.99**

RAW DATA OF FOOD WASTE GENERATION FROM PLATE LOSS

PLATE Loss	Day/kg							Total weight (week/kg)
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	
Café A	6.00	9.85	22.80	22.95	5.80	9.50	5.72	**76.80**
Café B	9.10	6.00	22.50	19.10	8.20	7.30	6.30	**78.50**
Café C	6.40	20.10	25.50	16.10	8.60	10.30	15.82	**102.82**
Café D	4.60	6.50	8.80	7.20	12.70	13.20	6.80	**59.80**
Café E	8.10	12.20	25.50	23.20	14.60	10.10	7.20	**100.90**
TOTAL (day/kg)	**34.20**	**97.90**	**105.10**	**89.15**	**49.90**	**50.40**	**41.84**	**418.82**

Appendix III

RAW DATA DAILY ELECTRICITY CONSUMPTION OF FIVE SELECTED CAFÉS

	Initial meter reading (A) (kWh)							Upon closure meter reading (B) (kWh)							Actual Consumption (A-B) (kWh)						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Café A	68517	68670	68792	68927	69056	69171	69307	68666	68792	68922	69054	69174	69302	69448	149	122	130	127	119	126	141
Café B	78452	78562	78720	78889	79051	79200	79331	78592	78717	78885	79049	79199	79330	79466	140	155	165	160	148	130	135
Café C	10341	10462	10605	10747	10884	11007	11138	10461	10602	10747	10882	11007	11137	11271	120	140	142	135	123	130	133
Café D	61203	61324	61455	61597	61733	61893	62048	61324	61453	61595	61733	61890	62048	62178	121	129	140	136	157	155	130
Café E	82211	82357	82497	82660	82819	82961	83104	82357	82496	82658	82818	82959	83104	83234	146	139	161	158	140	143	130

RAW DATA DAILY WATER CONSUMPTION OF FIVE SELECTED CAFÉS

	Initial meter reading (A) (m^3)							Upon closure meter reading (A) (m^3)							Actual Consumption (A-B) (m^3)						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Café A	1814	1817	1819	1822	1826	1828	1831	1816	1819	1822	1825	1828	1830	1833	2	2	3	3	2	2	2
Café B	2822	2826	2829	2835	2840	2843	2847	2825	2829	2834	2839	2843	2846	2849	3	3	5	4	3	3	2
Café C	6402	6405	6411	6418	6422	6426	6433	6405	6410	6416	6422	6424	6430	6436	3	5	5	4	2	4	3
Café D	3512	3516	3520	3525	3533	3542	3548	3514	3519	3525	3530	3539	3548	3552	2	3	5	5	6	6	4
Café E	1410	1415	1418	1423	1430	1437	1443	1414	1418	1423	1429	1434	1440	1445	4	3	5	5	4	3	2

Appendix IV

METHODOLOGY FLOW CHART FOR ONSITE WASTE AUDIT AT CAFÉS


Recording daily electricity and water consumption from metres prior café's operation hour


Onsite observation on food waste generation

BEFORE AND DURING CAFÉ'S OPERARATION HOUR

Calibration of weighing scale

Weighing the food waste generated from PREP and PLATE loss

Recording daily electricity and water consumption from metres after café's operation hour

AFTER CAFÉ'S OPERARATION HOUR